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KERATOPLASTY *

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Twenty years have passed since I began doing keratoplasty as described by von Hippel, Sr. For thirty years it had been attempted frequently, with but one successful result, that of E. Zirm in 1906. In recent years, with a great amount of material at my disposal, I have attempted the operation with several modifications.

Both my assistants and I have published several papers concerning the patients operated on in my clinic to the year 1925. It is my desire now, however, to give an exact description of my present procedure and to give a résumé of all my past experience with keratoplasty. I will confine myself to what I believe to be the only hopeful method, that of partially penetrating keratoplasty. A circumscribed disk of from 4 to 5 mm. in diameter, consisting of the entire thickness of the cornea of the diseased eye, is excised and is replaced by an equally large piece of normal cornea removed from a human eye that has been enucleated. This method is in contrast to the lamellar and total keratoplastic methods. In the former, only the superficial lamellae of the opaque cornea are excised, being replaced by an equally thick piece of transparent cornea. In total keratoplasty, an entire transparent cornea replaces the totally removed cornea. The method of partially penetrating keratoplasty promises so much better results that I will not consider the other two methods here mentioned, the use of which is limited to exceptional cases. Gradle [1] has already considered this problem.

* Submitted for publication, April 25, 1930.

* From the Eye Clinic, German University of Prague.

1. Gradle: Am. J. Ophth. **4**:895, 1921.

OPERATIVE PROCEDURE

Preparation.—Preoperative care of the eye is the same as before cataract extraction and consists in a general physical examination, a bacteriologic examination of the conjunctival sac and a cutting of the lashes close to the lid margin. If the lacrimal passages are normal, sufficient disinfection is obtained by thorough irrigation of the conjunctival sac at one hour intervals daily for one week with a solution of 1:5,000 oxycyanide of mercury. Should this prove insufficient, a "watery ointment" (Betti) of 2 per cent yellow mercuric oxide can be applied each evening.

One hour before the operation the patient is given a sedative. For several years I have been using the following preparation: acetylsalicylic acid, 0.5 Gm.; sodium bromide, 0.5 Gm., and codeine phosphate, 0.02 Gm.

Preparation for the enucleation consists in repeated irrigation of the conjunctival sac with 1:5,000 oxycyanide solution before operation.

Operation.—The eyelids and the adjacent parts of the face are washed with soap and water, and painted with a 5 per cent tincture of iodine. A 2 per cent solution of cocaine is repeatedly instilled over a period of twenty minutes; both

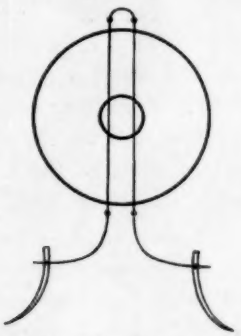

Fig. 1.—Insertion of suture in keratoplasty.

before and during this time a 1 per cent solution of physostigmine salicylate is instilled, in order that the contracted iris will protect the lens during the trephining. Then the eyelids are wiped off with benzine gauze, and the conjunctival sac is finally irrigated with a 1:10,000 solution of oxycyanide of mercury.

The orbicularis is paralyzed with from 2 to 3 cc. of a 2 per cent solution of procaine hydrochloride and epinephrine, by an injection from a point about on the lower anterior margin of the zygomatic bone. The needle is then carried upward, medially, down and outward. Then with a hypodermic needle, from 3.5 to 4 cm. in length, a retrobulbar injection of 1 cc. of a 2 per cent solution of procaine hydrochloride and epinephrine is made from a point on the inferior lateral orbital margin, through the lower lid.

Through the tendon of the superior rectus a bridle suture is inserted; in patients who do not turn the eyes upward sufficiently, it is inserted into the external rectus tendon in the left eye or the internal rectus of the right eye.

A black silk suture with a needle at each end is now inserted just above the superior margin of the cornea about 1.5 mm. from the limbus. Each end of this suture is then inserted in a similar manner below the lower margin of the cornea, and in such a fashion that when the silk is put on tension the two strands will pass parallel to each other over the future seat of the transplant (fig. 1). These silk sutures are now displaced to either side of the cornea, and the lids are temporarily closed.

For the surgeon who operates slowly, I would like to recommend this particular stage of the operation as the proper time for the retrobulbar injection, because sometimes the eyeball becomes too soft. Should this occur, the intra-ocular tension must be increased by firmly fixing the sclera over a muscle tendon by means of a pair of forceps and applying pressure.

The enucleation of the eye from which the transplant is to be taken should be done with the utmost care, so that the corneal epithelium is not injured in any way. I do this operation in such a manner that while the eye is being prepared to receive the transplant, an assistant is performing the enucleation. Should the operator be alone, he should do the enucleation first, placing the eye in a tightly closed sterile glass container.

While the assistant holds the enucleated eye, with sterile dry gauze, between three fingers, the surgeon also places two of his fingers on the equator of the eyeball and applies pressure so that the cornea is under sufficient tension. The von Hippel trephine (fig. 2) is placed over the center of the cornea when the thinnest possible disk is desired; otherwise it can be placed over the thicker

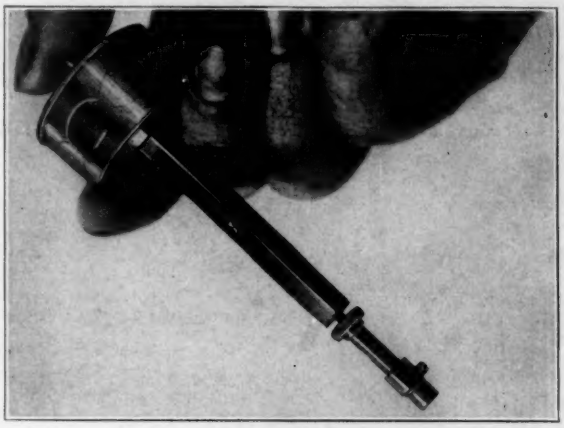

Fig. 2.—The von Hippel trephine.

periphery. The trephine must be held exactly in a vertical position, the spring released, and any change in the direction of the trephine absolutely avoided. The excised corneal disk is lifted up with a spatula or a spoon (sometimes it remains within the trephine), placed on a sterile piece of gauze which has been singed over a flame to free it from fine fuzz, and then covered with another piece of sterile gauze. If the disk is not completely excised, it is removed with the greatest care by means of a knife or fine scissors, but it should not be touched with forceps.

The lids of the eye to be trephined are now held open with lid retractors; epinephrine is instilled, both the black silk sutures (covering the cornea) are placed to the side and the surgeon fixes the eyeball with a pair of strong surgical forceps—on the right eye over the external rectus and on the left eye over the internal rectus. The assistant places the bridle suture on tension. The same trephine with which the transplant was obtained is rapidly immersed in boiling water, placed exactly vertically over the future site of the transplant and the spring released. The trephine is adjusted to a height of from 1 to 1.2 mm. less than that for the trephining of the transplant in order to prevent too rapid pene-

tration of the cornea with the danger of injuring the iris or the lens. If the cornea, however, is not completely penetrated, the trephine is slightly lengthened and the operation repeated; or, if only part of the cornea is penetrated, the excision is carefully completed with a small dull knife. Immediately afterward, the transplant is placed in position with a spatula. Extreme care must be taken so that the transplanted disk is placed in a proper position with the corneal epithelium uppermost. By the use of caution in traction and in tying the black silk sutures which are fixed to the conjunctiva, the position of the transplant is assured. If the iris is prolapsed into the wound, or if it is adherent to the removed disk, it is carefully excised with Wecker scissors.

The bridle suture and the lid retractors are removed; the lids of both eyes are closed and covered with moistened sterile gauze, then with cotton and a strip of adhesive. Finally, both eyes are well covered and protected by means of a roller bandage.

Postoperative Care.—The patient must remain in bed in the recumbent position for two days. At the end of this time the bandage is removed, and the black silk suture is cut without the use of forceps, and very cautiously removed. Pregl's solution and 1 per cent atropine sulphate solution are instilled, and both eyes are again bandaged. At the end of a week, the eye not operated on is allowed to remain open, but the other eye is kept bandaged for another week. During the third week the eye that has been operated on is uncovered several times a day for from one-half to two hours at a time. It is not until the end of the third week that the bandage on this eye is entirely removed, and then only if the transplanted disk is not bulging. Should the transplant be found to be bulging considerably, a pressure bandage should be applied. If this procedure does not reduce the bulging within two days, I make a careful puncture of the anterior chamber, and even repeat this treatment if necessary.

Indications.—With a patient under 14 years of age an attempt at this operation is inadvisable, because the child will not remain quiet, and operation under local anesthesia is usually impossible.

My later statistics will show that the operation is almost hopeless in cases of total leukoma, especially after chemical or open flame burns, and always when the iris is adherent to the cornea. Nevertheless, the operation is performed in such cases so that the surgeon and the assistants may be kept well trained in the technic, but it is never performed when the tension is increased. At the same time, it must be realized that an increase in tension will occur in all cases in which the tension is being kept down by a previous operation—cyclodialysis, iridectomy, trephine, etc.—these eyes never giving a useful result.

Eyes with total leukoma after serpiginous ulcers or burns must first be properly prepared. After the inflammation has completely subsided, massage of the cornea, and application of dionin, potassium iodide and yellow mercurous oxide ointments should be made for from six to nine months in order to clear up the cornea as much as possible, and at the same time to reduce to a minimum the inflammatory hyperemia in the leukoma. In cases of leukoma after destruction of the cornea by alkali (caustic lye, sal ammoniac), one should wait more than one year.

I operate only when good light perception and projection (candle at 6 meters) indicate a normal retina and optic nerve.

The Trephined Area.—As a rule, I use the center of the cornea, or the spot corresponding to the center of the pupil, which is located by scleral transillumination, in cases of a thick leukoma. The transillumination must be made from each quadrant of the eyeball, because the pupil is projected in an oblique direction from the source of light; should the transillumination be made from only one

spot, the center of the pupil would not be accurately located. In case there are no distinguishing marks on the leukoma by which the probable center of the pupil can be localized, one can mark this spot with a needle on which an alcoholic solution of methylene blue (methylthionine chloride, U.S.P.) has previously been allowed to dry.

During the transillumination one should also determine whether there are anterior or posterior synechiae, whether the pupil reacts, whether the iris is atrophic, etc.

In cases of scar after burns or ulcerations with a narrow, transparent, peripheral area of the cornea remaining, which, however, is not sufficient for an optical iridectomy, one should place the trephine in such a manner that an edge of it touches the edge of the transparent cornea.

Still more exacting are the preparations in cases of interstitial keratitis. Only those patients are operated on in whom there remains a thick central opacity. Congenital syphilis is usually present, and in each case there must be suitable treatment (injections of arsphenamine and bismuth) for a minimal period of from ten to twelve months. It is not essential to await a negative Wassermann reaction as it remains positive for ten years or more in congenital syphilis in spite of sufficient treatment. Special attention, however, should be directed toward the local treatment of the cornea. This should consist of the daily energetic massage for four weeks with mercurial ointment or yellow mercurous oxide, or an application of these ointments alternating with dionin ointment and followed by a pressure bandage for from one to one and a half hours on this eye alone. Should disinfection of the conjunctival sac still be found necessary, oxycyanide of mercury may be used.

Postoperative Course.—As a rule, a slight cloudiness of the implant occurs between the second and the sixth day, but after a week this usually clears up; therefore, in the majority of cases, this primary cloudiness has no bad prognosis. It is only in the most unfavorable cases that the cloudiness increases, and within three or four weeks the implant is completely opaque. In the event that the cornea does clear up after the first week, the fate of the implant is, nevertheless, not always assured; but as a rule, after four weeks, seldom earlier, the real cloudiness (which is usually definite) begins with an increase in the number of blood vessels, so that the implant is slowly changed into a nontransparent scar.

In favorable cases during the first weeks after the transplantation, a thickly scarred ring is formed, as a rule, along the border of the implant and around the entire circumference, while the remainder of the cornea often clears up considerably. This is similarly observed in all cases in which the scar of the cornea is not total, especially in interstitial keratitis and cases in which no further clearing up has been observed in spite of months of massage. The transplantation reacts as a tremendous biologic irritation, leading to a regenerative clearing up of the periphery of the cornea, even though the transplant may become almost completely opaque, which, however, occurs infrequently.

I have never seen an implant of the cornea that remained clear for six weeks again become totally opaque. Only in cases of healed interstitial keratitis can there occur in the implant a keratitis similar to the usual interstitial type, as a rule in the form of keratitis punctata profunda; but this occurs, apparently, when prolonged intermittent antisyphilitic treatment is not given. Under proper antisyphilitic treatment (especially massage of the cornea and energetic general treatment) either this implant keratitis can again clear up completely or only solitary blood vessels may remain.

I received word just before writing this article that in one of my first successful cases of transplantation performed twelve years before (fig. 3), an attack

of interstitial keratitis occurred several months ago in the eye that was not operated on. The patient is a man, aged 29, whom I presented before the Heidelberg Ophthalmological Society in 1920, with a transparent implant after interstitial keratitis and with a vision of 6/6 through correcting lenses. The eye that had been operated on was not involved in this attack; its vision had been preserved.

It is noteworthy that even in the oldest cases of transparent implant observed complete sensibility of the implanted cornea has not developed, but as a rule there does develop a sensibility to heavy touch.

On only one occasion have I observed in from two to three weeks after the transplantation, a torpid necrosis of the implant, which started peripherally, progressed centrally, and led to complete scarification of the trephined area. I have never seen suppuration result. A sloughing of the implanted disk occurs only within the first days (except in one case of degeneration of the cornea and in another of keratoconus) either when the lens capsule is injured during the operation so that the lens must be delivered or when the eye is already aphacic. In the latter instance keratoplasty must be avoided, because one is usually dealing with eyes in which the cataract followed a cyclitis and in which there is a liquid

Fig. 3.—S., a man, aged 29, showed interstitial keratitis with congenital syphilis in 1917. On May 14, 1919, keratoplasty was performed. On Aug. 5, 1920, vision with sphere +8, 0 was 6/6. This was unchanged at the time the patient was last examined.

vitreous, so that during the operation enough vitreous will be lost to cause collapse of the eyeball. In such cases the disk can be fixed only by careful suturing to the cornea on two opposite sides.

For further details of the operation, I refer the reader particularly to the last publication of my clinic (Stanka [1a]) and also to the description of keratoplasty in the surgical part of the Graefe-Sämisch Handbuch,[2] edited by me. I wrote this chapter because of the serious illness of Kuhnt at the time. I also reported nine cases of completed keratoplasty in which the implanted disk remained transparent.

Repetition of Keratoplasty.—When the implant is entirely opaque, and when the periphery of the cornea has not cleared up to the extent that an iridectomy could sufficiently improve the vision, one can attempt another transplantation

1a. Stanka: Arch. f. Ophth. **118**:335, 1927.

2. Graefe-Sämisch: Handbuch der gesamten Augenheilkunde, Leipzig, Wilhelm Engelmann, 1922.

after a lapse of three months, and can even repeat it several times. In only a few cases has the second or the third keratoplasty given a perfect result.

Size and Source of the Implant.—As a general rule I now use a trephine from 4 to 4.5 mm. in diameter, but if necessary any size up to 6 mm. can be used for the disk. As concerns the source of the implant, I have not found that it made any great difference whether the enucleated eye was normal in its anterior segment with, for example, sarcoma of the choroid posteriorly, whether a transparent cornea after iridocyclitis was used, or whether the donor was old or

Fig. 4.—Viktor K., a youth, aged 19, had interstitial keratitis thirteen years ago; there were two recurrences, the last six years ago. In the right eye, vision was 6/24. In the left eye it was limited to counting fingers at 1.5 meters, with a contracted pupil; with a dilated pupil, it was 2/60. On Nov. 20, 1925, keratoplasty was performed. On Feb. 24, 1929, with cylinder —3.50 axis 160, vision in the left eye was 6/12.

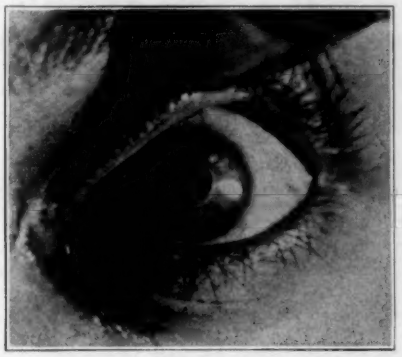

Fig. 5.—Enlarged view of eye shown in figure 4.

young. In many cases my co-workers and I have compared the blood of donor and recipient for hemolysis, but we have been unable to correlate our results as regards prognosis in the same or different blood groups.

RESULTS

In all, a total of 174 keratoplasties have been performed in my clinic to July, 1929, 7 of them by my assistants and the remainder by me. In 35 cases the keratoplasty was performed only for the pur-

pose of replacing an extensive adherence of the iris to the cornea with a fistulation or staphyloma—therefore, not for optical, but for purely mechanical purposes. These cases gave unfavorable results. In the majority of instances there was already a slight increase in tension. The implanted disks remained clear in only two instances; in six other cases they became only partially cloudy.

Among the 139 patients who were operated on in order to improve vision, 113 had leukoma after flame or chemical burns or after ulcera-

Fig. 6.—Jaroslav H., a youth, aged 15, in 1924 showed interstitial keratitis of both eyes, with congenital syphilis. Vision was 6/36; with correction it was 6/24. On May 4, 1926, keratoplasty was performed. On March 5, 1928, with sphere —0.25, cylinder —2.50 axis 20, vision was 6/8. Binocular vision was present.

Fig. 7.—Anna S., a woman, aged 22, had congenital syphilis with interstitial keratitis one year before operation. Vision was 2/60. On May 6, 1927, keratoplasty was performed. At the last examination, on Jan. 18, 1930, vision was 6/24 and she read Nieden test type no. 4. Fine obliterated vessels in the implant.

tion with destruction of the entire cornea. In 22 cases, the majority with aphacia, the implants did not remain in place. In these a closure of the trephined hole was obtained eventually by means of a conjunctival flap. The disk remained clear in only 15 cases and partially transparent in 31. All of these cases, however, showed improvement in vision. In 45 cases the implant again became totally opaque. The

most unfavorable results were obtained in cases in which there was a total scar of the cornea after alkali burns. Only once was the result worse than the original condition; this was in a patient who had perception of light before operation and in whom amaurosis developed afterward.

The greatest improvement of vision was from hand movements to 6/6.

More favorable were the results in the previously mentioned 26 cases that showed thick scars after interstitial keratitis. In 1 instance, however, the disk was lost and in 6 others the implant became opaque. In contrast to those unfavorable results, 2 cases showed partially transparent implants with improvement of vision, while 17 cases revealed very clear corneas with marked improvement of vision. Some of the most satisfactory cases I shall report in detail.

Although the amount of material is too small to allow me to estimate results on a percentage basis, I might say that of the 139 cases of leukoma after burns or ulceration, 22 per cent resulted in improvement, in some instances to a remarkable degree. Of the cases of interstitial keratitis, however, 19 showed marked improvement, with an occupationally useful eye in 17 instances. Only once was vision the same after as before the operation, and only once did vision become worse. The latter case showed absence of the anterior chamber and a flat cornea following interstitial keratitis in which the lens was injured during the trephining.

CONCLUSIONS

In eyes with leukoma in patients over 14 years of age in whom the anterior chamber is normal, and in eyes without an increase in tension, keratoplasty will be successful in about 22 per cent of all cases. It will be successful in about 73 per cent of all cases of interstitial keratitis.

One should decline to do the operation in aphacic eyes and in cases of wide, flat synechiae between the iris and the corneal scar, except for the exercise of technic; the patient has nothing to lose.

Keratoplasty should never be performed in cases of glaucoma or in patients under 14 years of age. It should never be attempted sooner than one year after all disease processes in the cornea have completely subsided, and even then not before the eye has been given several months of preoperative preparation.

As transplantable material may be obtained from the eyes of young as well as of old persons with normal corneas, it is indifferent whether the remaining anterior segment is normal or pathologically changed, and whether the eye of the donor reveals glaucoma or hypotension (phthisis bulbi).

COLOBOMA LENTIS*

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Coloboma of the lens is a congenital defect in the border of the lens together with a loss of lens substance, the lens otherwise being normal in shape. Although the condition is rare, the reported types are of considerable diversity, and several attempts at classification have been made. The edge of the defect may be straight, indented, curved in or projecting out. The majority of reported cases show the coloboma to be in the typical direction, downward, or down and slightly in or out. It also has been found upward, inward, up and in, up and out, and outward. Other congenital anomalies, such as coloboma of the iris, ciliary body and choroid, are frequently found associated with it. Coloboma lentis must be differentiated from ectopia lentis, in which the displaced lens often gives the impression of a defect. In ectopia, however, the margin of the lens shows no actual defect and the condition is usually bilateral, the direction and displacement being symmetrical.

As to the causation of coloboma lentis, several theories have been advanced. Hess [1] believed that the vessels of the lens sheath persisted for an abnormally long time, so that the growth of the lens was prevented by local pressure. Heyl [2] took the opposing view, that there was an insufficient or arrested development of the vascular lens sheath, causing an arrest in the development of the lens, due to poor nourishment. Becker [3] attributed the defect to a local insufficiency of the zonule. The latter theory was supported by Wessely,[4] who performed iridectomies on new-born rabbits and later demonstrated that the zonular ligament was either stretched or affected with minute holes at the point corresponding to the iridectomy. Van der Hoeve [5] repeated these experiments, determining the weight of the lenses at different ages and finding that the lens was always lighter in the eye that had been operated on, the difference being greater when a coloboma had resulted. Manz [6] considered the cause to lie in the coloboma of the choroid, which is

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* From the Wilmer Institute, Johns Hopkins Hospital.
* Read before the Baltimore Ophthalmological Society, Feb. 28, 1930.

1. Hess: Klin. Monatsbl. f. Augenh. **30**:106, 1892.
2. Heyl, A. G.: Coloboma Lentis, Rep. Internat. Ophth. Cong. **5**:16, 1876.
3. Becker: Zur Anatomie der gesunden und kranken Linse, Wiesbaden, 1883.
4. Wessely: Arch. f. Augenh. **65**:295, 1910.
5. Van der Hoeve: Arch. f. Augenh. **72**:145, 1912.
6. Manz: Arch. f. Ophth. **26**:154, 1880.

usually found to be associated with it. Parsons [7] pointed out that the latter theory is essentially the same as that of Hess, depending on the persistence of the connective tissue, which in this case remains in connection with the fetal cleft.

Collins [8] and Mann [9] investigated the embryologic development of the zonule, and from this attempted to deduce the cause of coloboma of the lens. According to Collins, the zonule of Zinn is developed by adhesions between the pars ciliaris retinae and the lens capsule. As the eyeball grows, these adhesions stretch and become fibers, being attached at one end to the ciliary body and at the other end to the capsule of the lens. The tension is equably distributed around the circumference of the lens, which thus develops in an even manner. If for some reason the adhesions between the ciliary body and the capsule of the lens fail to develop at one point, zonular fibers will not be formed at this

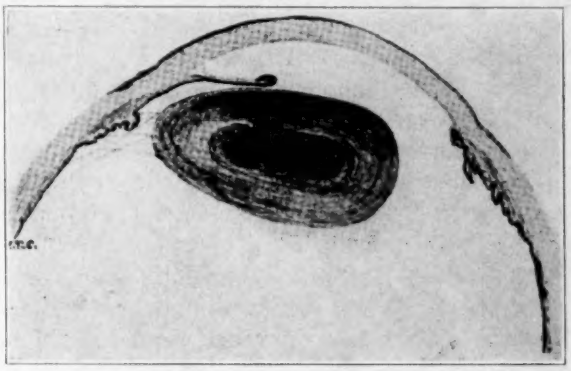

Fig. 1.—Cross-section of eye showing coloboma of the iris and lens (Collins).

point. In the subsequent growth, traction will be exerted on all parts of the lens, except opposite this defect, where no development will take place. The amount and shape of the subsequent deficiency would depend on the extent of the defect in the suspensory ligament. This part of the lens margin will also be thicker than the remainder, as is well shown by Collins in a cross-section of an eye. My case differs from this, however, in that the margin of the colobomatous portion was considerably thinner than the remainder of the lens.

Mann does not agree with Collins' concept of the formation of the zonular fibers, but is in harmony with his explanation of the origin of the coloboma lentis. She divides the vitreous formation into three

7. Parsons: The Pathology of the Eye, 1906, vol. 3, p. 850.

8. Collins, Treacher: London Ophth. Hosp. Rep. **13**:81, 1893.

9. Mann, Ida: The Development of the Human Eye, New York, The Macmillan Company, 1928, p. 151.

periods. The first period is that of the primary vitreous, formed from the ectoderm of the lens plate and optic vesicle, with secondary ingrowth of the vascular mesoderm. This stage ends at 13 mm., at which time the hyaline capsule of the lens is secreted, preventing the lens from taking any further part. The secondary vitreous is then formed by a fresh outgrowth from the inner layer of the optic cup, and from the peripheral portion of the optic cup. This stage ends with the appearance of the ciliary region, at about 65 mm. The tertiary vitreous then begins to make its appearance about the third month, concomitant with the increasing rate of growth at the margin of the cup. The tertiary vitreous fibrils begin in this region and become more numerous and coarser, meanwhile becoming displaced further forward by the growth of the cup margin. The fibrils from the ciliary region continue to grow and gain attachment to the surface of the hyaline capsule of the lens by adhesions, the vessels of the tunica vasculosa lentis having almost entirely disappeared. These fibrils soon become arranged in a regular manner, forming the suspensory ligament of the lens, and show the adult arrangement at 110 mm. At this stage the folds of the ciliary processes have so grown that they are practically in contact with the lens all around its equator. The fibers, however, have disappeared from the apexes of the ciliary processes, and now arise only from the valleys. As the space between the ciliary body and the lens then widens, the zonular fibers become longer and more taut.

It can thus be seen that Mann's work disproves the theory of Collins that the zonular fibers are formed by the adhesions developing between the ciliary body and the capsule of the lens. She concurs with him, however, in the theory that if the zonular fibers for some reason fail to develop over one region, the pull of the other fibers will modify the shape of the lens in such a manner that the corresponding sector will be shorter and thicker than normal, and give rise to the appearance of a notch. It is at just this point that her theory diverges from the facts of the following case.

The case to be presented is of interest in that as far as can be determined it is the only case of coloboma lentis that has been studied with the aid of the slit-lamp, and it is felt that some of the observations herein recorded may clarify the previous speculative theories as to the origin of the condition.

REPORT OF A CASE

M. F., a white girl, aged 18 years, was admitted to the Wilmer Institute on Jan. 5, 1930. The family history was unimportant, as was the past history, except for attacks of vertigo and unconsciousness during childhood, which became less frequent; no convulsions accompanied these attacks. When the patient was 2 weeks of age, the mother noticed that both pupils were irregular, and that the right eye turned out slightly. The patient was given glasses at 8 years of age. She has no recollection of ever having seen with the right eye.

Examination of the eyes showed that externally the right eye deviated outward 30 degrees. Movements were well performed. The lids and conjunctiva were normal. The cornea was clear. A coloboma of the iris was present from 8 to 10 o'clock, measuring 3 mm. The pupil responded to both direct and consensual light. The tension was normal. The right cornea measured 9 mm. in diameter, as compared with a diameter of 11 mm. in the left eye. The lids and conjunctiva of the left eye were normal. There was a coloboma of the iris at 6 o'clock. The pupil reacted actively to direct and consensual light. Tension was normal.

Ophthalmoscopically the outer margin of the lens in the right eye could be seen about one fourth of the distance from the temporal limbus, curving slightly inward. Several patches of opacity were present in the posterior cortical layers, near the margin. A clear view of the fundus could not be obtained, but a large white area was seen extending directly from the region corresponding to the coloboma of the iris toward the nerve head, indicating a coloboma of the ciliary body and choroid. In the left eye the disk was of normal color and outline, with

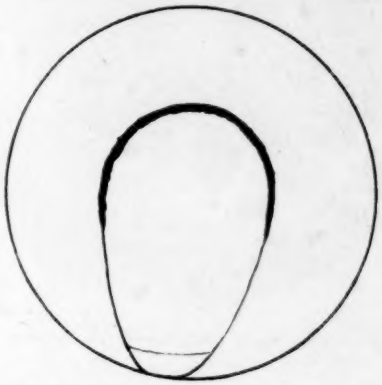

Fig. 2.—Coloboma of the iris of the left eye; the lens and zonular ligaments are normal.

physiologic cupping. The vessels appeared normal. The macular and the peripheral fundi were clear, with no evidence of a coloboma of the choroid.

Slit-lamp examination of the right eye showed the cornea to be clear. No deposits were seen on its posterior surface. The iris showed a coloboma involving the entire temporal side. The iris pattern appeared normal. Along the pupillary margin there was a heaping up of the iris pigment from the posterior pigment layer, as in incomplete ectropion uveae. The temporal margin of the lens was definitely seen at about one fourth of the diameter of the cornea from the temporal limbus, the margin curving inward. The lens substance shelved away sharply on the temporal side, so that the margin was quite thin. There were several fluffy opacities in the posterior cortical layers, just away from the margin. On the lower part of the anterior capsule of the lens were arranged crescentic whorls of pigmented cells, the remains of the tunica vasculosa lentis. As illustrated in figure 3, there was a defect in the zonular fibers corresponding to the coloboma of the iris. A few fibers were seen stretching above and below, converging toward the lens. Between these upper and lower fibers the vitreous protruded into the anterior chamber. Numerous pigment granules were strung along the zonular fibers like beads. There was no increase in the visibility of the

aqueous ray. In the left eye the cornea was clear and the anterior chamber of normal depth. The iris was of normal pattern, with no heaping up of pigment at the pupillary margin. The pupil had an inverted pear shape, due to a coloboma of the iris, extending from the margin to the root. With a dilated pupil, the zonular fibers could be seen; this lower sector seemed to be normal. There were

Fig. 3.—Slit-lamp drawing of the right eye. The defect in the zonular fibers can be seen in the center of the coloboma.

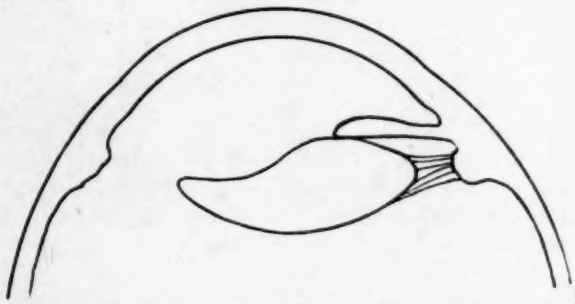

Fig. 4.—Diagram of a cross-section of the right eye, illustrating the absence of the iris and defect in the lens substance.

a few fine, dustlike opacities in the nucleus of the lens. The anterior portion of the vitreous appeared normal. Vision was 2/100 in the right eye and could not be improved with glasses; in the left eye it was 20/50+2; with sphere —1.00, cylinder —0.50 × 180 the vision was 20/30—1.

In the right eye the field was greatly contracted for large objects, and in the left eye was normal.

COMMENT

This case thus represents a defect in all three of the embryologic ocular layers. The coloboma of the lens indicates a disturbance of the growth of the surface ectoderm, from which the lens vesicle buds off. The remains of the tunica vasculosa lentis and the coloboma of the iris represent a failure of the normal process of mesodermal atrophy, as demonstrated by Mann. A coloboma of the choroid is, in all probability, due to a deficiency in the neural ectoderm of the optic cup. The only plausible explanation for the entire picture lies in the persistence of mesodermal structures. Whether this persistence is due to a disturbed nutrition or a toxic process leading to failure of retrogression, cannot be stated. That it is the probable cause of these congenital anomalies is lent support by the work of Mann on the iris structures, and is confirmed in the present case by the persistence of the tunica vasculosa lentis and by the shelving of the temporal margin of the colobomatous lens. I have stressed the latter point because it negates the theories of Collins and Mann, who attributed the lenticular defect to a lack of tension of the zonular fibers. I believe, with Hess, that the vessels of the lens sheath persisted for an abnormally long time, so that the growth of the lens was prevented by local pressure.

VARIATIONS IN THE INTRANEURAL COURSE OF THE CENTRAL VEIN OF THE RETINA*

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During the course of the examination of serial sections of a number of optic nerves for an entirely different purpose, frequent variations in the course of the central vein of the retina with relation to the course of the central artery of the retina were found. Because these variations occurred with such regularity and in such a considerable percentage of the cases examined, and because they differed markedly from the usually described course of the central vein, it was considered of importance to make this record of them.

Whitnall, who followed the description of Hoveloque, gives the following course for the central vein.

> The vena centralis retinae accompanies the artery of the same name in its intraneural course, though according to Hoveloque (1920) it emerges from the optic nerve on either the lateral or inferior side nearer (10 mm. from) the globe; it most frequently opens separately into the cavernous sinus, but sometimes joins the superior or even the inferior ophthalmic sinus.

The description given by Salzman is essentially the same. Salzman stated:

> At the posterior end of the central connective tissue strand the peripheral glial mantle is turned in, like the pial sheath itself, and continues along the central connective tissue strand for a varying distance. This place, usually spoken of as the entrance of the central vessels, lies below, and somewhat nasal, according to Deyl, and almost straight below according to Strahl.

The position of the exit of the central blood vessels of the retina from the sheath of the optic nerve has been studied by injection methods. Particular attention has been directed to the quadrant of the nerve from which the exit of the vessels is made. Vossius [1] examined four specimens prepared by injection and six that had not been so prepared. From these he concluded that "the vessels enter in all cases in the lower circumference of the nerve stem and usually in the lower outer quadrant." It was recognized at that time that in the embryo the vessels enter in the lower inner side. To explain the discrepancy between the observations in the embryo and those in the adult, Vossius believed that the globe rotated through an arc of at least 90 degrees from within, below and outward. To substantiate this view further,

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1. Vossius: Arch. f. Ophth. **39**:119, 1893.

he demonstrated a change in the relative position of the levator palpebrae superioris and the superior rectus muscles in the course of their development. Later Deyl [2] employed injection methods in a study of the blood vessels, and examined the optic nerves in twenty-one human adults. His conclusions were that the entrance of the blood vessels is at a distance of from 6 to 15 mm. behind the globe and in the lower medial quadrant. This corresponds with the position in the embryo, and he stated that no tortion through an arc of 90 degrees takes place. More recently Mann has shown that, on the basis of embryologic development, such a rotation cannot occur.

The central blood vessels near the level of the lamina cribrosa have been studied by Beauvieux and Ganelmino.[3] They examined specimens prepared by injection and cut serially, and their contribution has

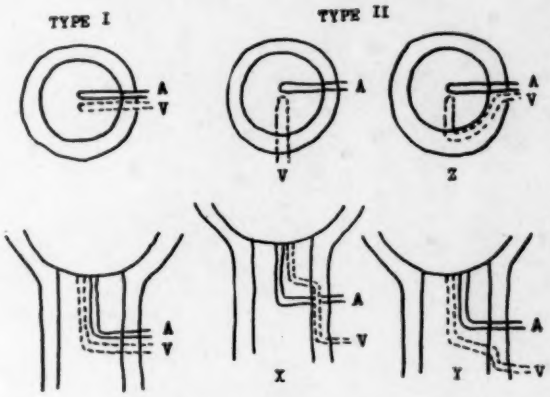

Fig. 1.—Variations in the course of the central vein of the retina. *V* indicates the vein and *A* the artery. Type I represents their course in fifteen optic nerves, or 42 per cent. Type II represents their course in twenty-one optic nerves, or 58 per cent. Of type II, the variation illustrated by the drawing *x* was found in seventeen nerves, or 81 per cent, and that illustrated by *Y*, in four nerves, or 19 per cent. *Z* represents the course of the vein in four nerves of type 2.

to do particularly with the anastomoses of the central blood vessels with the blood vessels of the choroid.

Variations in the intraneural course of the central vein are indicated in the descriptions of Yamaguchi [4] and of Paton and Holmes.[5] In 1903, Yamaguchi reported a case of postpapillitic atrophy from a tumor of the brain in which a bilateral thrombosis of the central vein developed and a swelling of the disk of 3 or 4 diopters. The nerve was examined

2. Deyl, J.: Anat. Anz. **11**:687, 1895-1896.
3. Beauvieux and Ganelmino, R.: Compt. rend. Soc. de biol. **90**:1241, 1924.
4. Yamaguchi, H.: Klin. Monatsbl. f. Augenh. **41**:180, 1903.
5. Paton and Holmes: Brain **33**:389, 1911.

in serial sections. The central vein was found to pass straight back through the central portion of the nerve, then to turn at right angles to the direction of the nerve stem to a subpial position on the edge of the nerve. It then turned at right angles again and proceeded backward in the pia for some distance, to turn again at right angles and then traverse the intervaginal space and pass through the dural sheath. Yamaguchi believed the course of the vein in his case to be unusual. In 1911, Paton and Holmes in a study of papilledema, examined a

Fig. 2.—Both the artery and the vein are passing from the center of the nerve to the periphery at the same point.

series of sixty eyes histologically, and in five instances examined serial sections of the optic nerve. Their comment in regard to the course of the central vein is as follows: "It passes from the center toward the pia usually before the artery and often winds round the nerve under the pial sheath."

Variations in the intraneural course of the central vein may also be anticipated by the embryologic development. Mann [6] stated:

There is no accompanying vein with the hyaloid artery. This does not begin to appear until during the third month, when there is recognizable on either side

6. Mann, I. C.: The Development of the Human Eye, New York, The Macmillan Company, 1928, p. 230.

of the artery two other blood channels. As they pass backward from the ocular end of the nerve, they approach each other, and finally coalesce at a variable distance behind the disc, forming thereby the main trunk of the vena centralis retinae.

From these statements it is seen that although the relationships of the central blood vessels at the level of the lamina cribosa and at their point of exit from the dural sheath have been studied, little attention has been focused on their intraneural and intervaginal course.

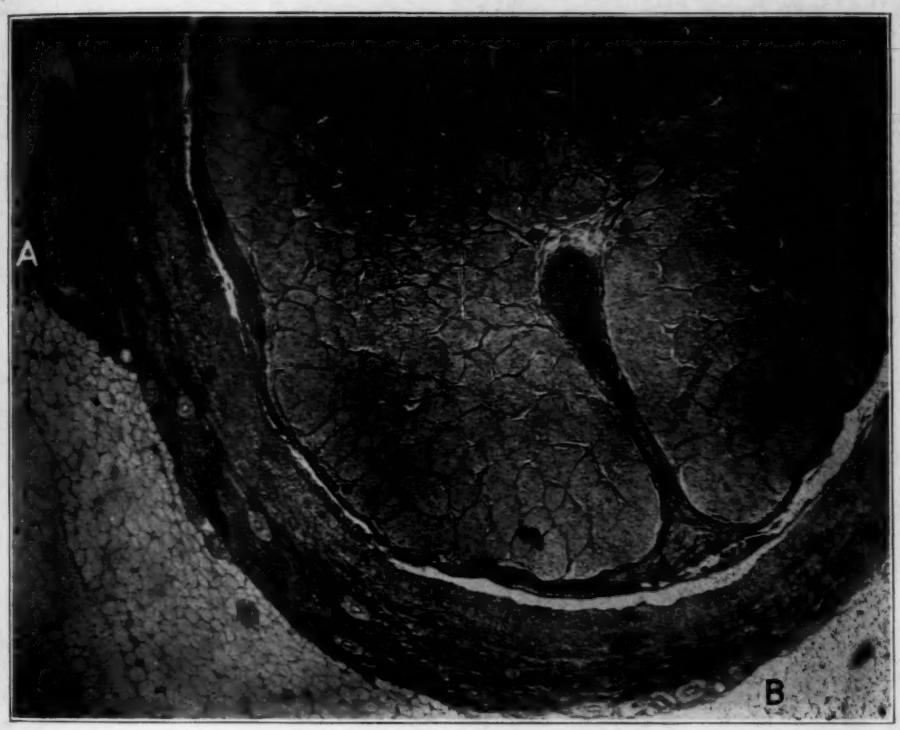

Fig. 3.—*A* shows the central vein of the retina slightly compressed in a subpial position. *B* shows the artery coming to the periphery of the nerve in a direction at right angles to that taken by the vein.

OBSERVATIONS

The present observations were made from the examination of serial sections of thirty-six optic nerves obtained from twenty cases. These cases were from the services of Dr. Frazier, Dr. Spiller, Dr. Stengel and Dr. Gittings at the University Hospital. They included eighteen cases of tumor of the brain, one of abscess of the brain and one of gumma of the brain. Horizontal sections were made beginning about 2 mm. behind the globe and extending nearly to the intracranial portion of

the nerve. The sections were cut 20 microns thick and in some instances every fifth, and in other instances every tenth, section was prepared and examined. In four instances, the sectioning began within the optic papilla just anterior to the level of the lamina cribrosa.

The artery and the vein pass straight posteriorly through the center of the optic nerve, from the level of the lamina, usually, but not always close together. This portion of their course is uniform. At a variable distance from the lamina, the blood vessels turn and proceed toward

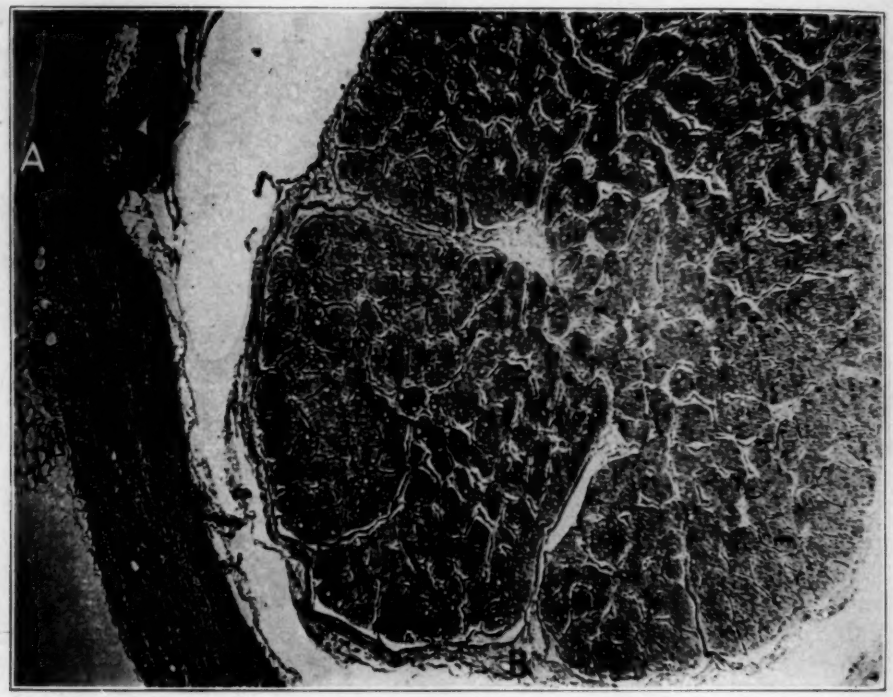

Fig. 4.—The directions taken by the artery and vein are shown in the same section. The artery is opposite *A*, and the vein at *B*. In coming to the periphery, the artery and the vein make an angle of 90 degrees to each other.

the periphery of the nerve. Based on the course at this point, two types may be distinguished. We may speak of type 1 in which both the artery and the vein proceed to the same point in the arc of the periphery of the nerve, and of type 2 in which they proceed to different points on the arc of the nerve. In this second type, the artery and the vein diverge from each other usually at an angle of 90 degrees, although it may be slightly less or greater than this in some instances. The artery and the vein proceed to the periphery as indicated by the first type in fifteen nerves or 42 per cent of the instances, and as indicated in the second type in twenty-one nerves or 58 per cent of the instances.

In the first type, in which the artery and the vein proceed to the periphery of the nerve at the same point, the blood vessels, when they reach the point of turning, making a right angle turn with relation to the length of the nerve stem, and in five instances the artery and the vein continue together, and in ten instances the artery is slightly anterior to the vein. Both vessels usually cross the intervaginal space and pierce the dura immediately. In one instance in which the vein

Fig. 5.—The central vein of the retina is shown passing about the periphery of the nerve through an arc of 90 degrees from its original position at *A* to the position of the central artery of the retina at *B*.

ran posteriorly within the pia before crossing the space, this distance amounted to 0.9 mm. and in another 3 mm. (fig. 1).

In the second type, in which the artery and the vein diverged from each other at an angle of 90 degrees in their course to the periphery, the vein approached the periphery anterior to the artery in seventeen nerves, or 81 per cent of the instances (fig. 1, *x*), and the artery was anterior in four nerves, or in 19 per cent of the instances (fig. 1, *y*). The direction of the artery was at right angles to the length of the nerve stem, while that of the vein was slightly greater than a right

angle in all but four cases, in which it was at right angles. The artery crossed the intervaginal space immediately after its appearance on the periphery of the nerve, and in all instances crossed the space before the vein, even though the latter had appeared in a subpial position while the artery was still within the center of the nerve. In four of the nerves in which the distance of the subpial course of the vein was measured, the shortest was 3.5 mm. and the greatest 8 mm.

In four of the cases examined, in which the artery and the vein diverged from each other as in the second type, the vein, after coursing posteriorly in the pia, turned at right angles about the periphery of the nerve, passing through an arc of a quarter of a circle, and made its exit from the dura at a point corresponding to the line of exit of the artery (fig. 5).

COMMENT

The course of the central blood vessels is of importance in clinical conditions such as thrombosis of the central vein and in the production of papilledema. In the four cases in which the vessels were followed in serial sections through the lamina cribrosa, there was a slight narrowing of the caliber but no indication of a constriction of the lumen of the blood vessels. On the other hand, at the point of exit from the nerve, there were not only a number of acute angles, as many as four or five in the case of the vein, but at places the lumen of the vein appeared compressed. These circumstances, in the presence of a change of the intima of the vessel or a change in the blood stream, would favor the formation of a thrombus. Further, the relatively long course of the vein in the subpial and intervaginal space, which occurred in the nerves of the second type, would favor compression of this vessel by increased pressure of the fluid within the dura in cases of increased cerebrospinal fluid pressure, and hence be of importance in the production of papilledema.

SUMMARY

In summary, the following statements may be made regarding the course of the central vessels in the optic nerve and intervaginal space.

1. In 42 per cent of the cases, the artery and the vein pass through the center of the nerve, and at a variable distance behind the lamina cribrosa they make a turn at right angles to the direction of the nerve stem and approach the periphery of the nerve. Usually, they proceed together and cross the intervaginal space immediately after gaining a subpial position.

2. In 58 per cent of the cases the artery and the vein pass at a variable distance behind the lamina cribrosa, to the periphery of the nerve in such a way as to make a right angle course with each other.

This is an anatomic point to which, as far as I have been able to determine, attention has not previously been directed.

3. In the cases listed under type 2, the artery and the vein approach the periphery of the nerve at different levels within the nerve, the vein usually doing so first; but, no matter which vessel comes to the periphery first, the artery is always the first to cross the intervaginal space and pierce the dura, and may do this a considerable distance anterior to the point of the venous crossing.

LENS CHANGES AFTER MIDDLE AGE*

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Observations with the slit-lamp covering a period of almost ten years have led me to certain views on the types and frequency of opacities of the lens in persons beyond middle life.

I shall first discuss briefly the anatomy and growth of the lens. The lamellar structure of the lens from within outward, as seen in the beam of the slit-lamp, is as follows: The innermost unit—the embryonic nucleus—presents on its anterior surface the vertical, and on its posterior surface the inverted, Y suture. It shows a clearer, therefore presumably less dense, central interval. Surrounding this structure one next sees the surfaces of the external embryonic nucleus presenting a somewhat more complex suture design. These two nuclear entities approximately constitute all of the lens as it is at birth.

Under the anterior capsule of the lens is the layer of epithelial cells. At the equator of the lens they undergo a gradual transition into lens fibers. When the cells reach the equator, they tip forward and grow in length. They lie parallel to the circumference of the lens and end anteriorly and posteriorly when they reach their respective suture lines. These suture systems vary anteriorly and posteriorly within their respective lamellar layers, on the basis of the original vertical and inverted Y formation. Hence, because of this inversion of the suture systems, fibers that extend a long distance to reach their destination anteriorly need go only a short way posteriorly, and vice versa. Therefore all fibers are equal in length when mature. There are about 2,000 of these individual lens fiber cells in a row in the equatorial lens circumference. The individual cells of the successive layers underlie their predecessors in structural exactitude. Their piling up gradually develops 2,000 straight radial lines of (fiber) interspaces in the peripheric cortex of the lens. These interspaces bound the radial lamellae of Rabl. They present about 2,000 potential lines of cleavage or separation for a possible peripheral spoke formation in cataract development. Deeper within the cortex toward the supranuclear zone, there is a more decided intermingling among the older lens fibers.

The deposition of fibers forming new cortex and the sclerosis of the nucleus and older layers are a process that is continuous throughout life. By virtue of this change the nuclear zone gradually becomes more condensed and the lens flatter.

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This condensation of the nucleus gives to it a higher refractive index, and thus optically the flattening of the lens is neutralized. Thus the refraction of the eye is kept in a state of balance throughout life.

After the process of sclerosis of the lens has attained a certain stage, it is called presbyopia. In certain persons this physiologic regression, if excessive, may reduce the transparency of the lens and visual acuity.

Immediately under the capsule of the lens Vogt differentiated another lamellar zone, which he provisionally designated the zone of cleavage (Abspaltungszone). A very peculiar thing happens to the lens at about puberty or afterward. A certain lamellar layer in the middle of the cortex becomes sharply demarcated, and presents a luminous surface contour reflex. The lens within this zone was called the "Alterskern" by Vogt. In age, its surface luminosity is often so marked that it gives the lens a grayish appearance through the pupil, and this has been mistaken for cataract. This peculiar differentiation in the cortical lamellar structure, however, does not interfere with the transparency of the lens nor with visual acuity. The design on this surface is usually that of a four-branched suture. At times it may appear to be studded with many large knobs.

NUCLEAR SCLEROSIS

The type of senile cataract is determined in a great measure by the degree of sclerosis of the whole of the lens. When the sclerosis is quite advanced the cataract is the type which is known as "nuclear sclerosis" because of the greatly increased density of the nucleus. This increased nuclear density is sharply delimited so that at times there may be a lens within a lens, or one with two foci. The lens presents a very different focus through its periphery than through the middle. The difference between the refractive indexes of nucleus and cortex may be as great as that between lens and aqueous.

In many cases the nucleus may be dark red or even black (cataracta nigra). In these cases there is the same abrupt contrast between the color of the nucleus and that of the cortex. The latter is absolutely colorless. Much to my surprise, I have found cases of this type in which the process was extreme in one eye and there was little coloration of the nucleus in the other. The excessive sclerosis of the lens nucleus in these eyes often causes them to acquire an increase in their refractive power. It is this change that brings on a myopia in an emmetropic person and enables him again to see near objects without glasses (second sight). It is a process of conservation unless the sclerosis becomes excessive and thus reduces the visual acuity by impairing the transparency of the lens. In uncomplicated nuclear sclerosis, the cortex of the lens is usually free from changes.

SENILE CATARACT OF THE LENS CORTEX

Another and most common type of senile cataract is that in which one finds supranuclear cortical changes in the form of radial and concentric fissures. These fissures, when incipient, are filled with fluid. These changes are evidences of friability of the cortex. Lenses may incline to radial or to concentric fissure formation, or there may be a combination of the two types. The incipience of this process is a characteristic picture under the slit-lamp, as is adequately shown in the works of Vogt and others. Radial fissures are usually an involvement of the radial lamellae of Rabl. The tendency of these splittings is shown in the stereophotograph. It is the lens of a young dog, first steamed and then dried. It shows a predisposition to radial spoke formation on anatomic structure lines. Radial spokes in their incipience present a black area in the narrow beam of the slit-lamp. While these

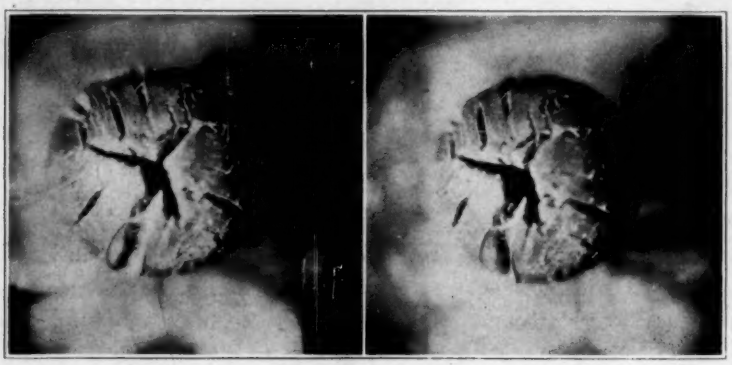

Fig. 1.—Radial clefts in the cortex of the lens.

areas predict a threatening opacification, the process may remain thus stationary for many years. I recently had occasion to check up on an incipient spoke recorded in a case history taken six years before. There had been no progression during this period, even when it seemed imminent. If one therefore finds gray spokes visible with the ophthalmoscope, and no evidences of threatened progression (fresh fissure formation) with the slit-lamp, one may presume that the development of this cataract is at a standstill, possibly permanently.

Figure 2 shows a series of narrow beam slit-lamp images (seried) along two radial fissures. The black areas are fluid.

Senile lenses of a similar type may also show a disposition to fissure formation in a concentric (lamellar) direction. These, when fully advanced, present the well known dark plaques seen in the lens with the ophthalmoscope. While they are fissures in a concentric direction, they are not splittings along definite anatomic lines. The fibers are too

intermingled to allow of this along smooth concentric planes. This type of splitting in its incipience (invisible with the ophthalmoscope) shows a most characteristic slit-lamp picture. There are so many fibers crossing the fissure (from one lamella to another, if it may be so designated) that these form a wavy design which outlines the area of concentric separation. The wavy lines parallel to each other are due to rows of fibers belonging to a single lamella bridging the separation at right angles to the direction of the fibers. This I believe to be the explanation of this wavy, combed-like appearance, which, to slit-lamp observers heretofore has seemed inconsistent with or inexplicable on the basis of anatomic lines or of direction of fibers. It is of utmost

Fig. 2.—Seried narrow slit-lamp images. The three on the right cross an incipient fissure extending from 4 o'clock. The four on the left present an incipient progression (black) of a radial spoke (white) at 8 o'clock.

clinical importance that the use of the slit-lamp has given insight into this most interesting phase of progression in the development of cortical cataract.

It is not fully understood why lenses show this tendency to fissure formation in the cortex. There have been varied attempts at explanation, such as excessive contraction of the nucleus, retardation in the development of new lens cortex and traction of the zonule fibers.

In certain lenses the nucleus, because of its weight, behaves as a foreign body and, because of a softening of the cortex, gravitates

within the capsular bag (morgagnian cataract). In view of this and the fact that relaxation of the zonule fibers in efforts at accommodation still continues at this period of life, it is believable that this constant trauma of the weight of the nucleus on the cortex may initiate the changes. This, in a way, would explain why the incipient lesions of this type are almost always first seen below and on the nasal side.

TOXIC CATARACT (CATARACTA COMPLICATA)

An extremely common type of lens involvement in middle life is that known as toxic cataract or cataracta complicata. Ophthalmologists are familiar with it because of its frequent occurrence in conjunction with retinal detachment, myopia, choroiditis and other degenerative conditions of the eye. It is surprising how often it is found in eyes that fail to show other pathologic processes. In these one may suspect a low grade choroiditis or some other toxic etiology. A very slight involvement of the lens constituting a serious threat to the vision is a common slit-lamp observation.

The frequency of toxic cataract leads me to think that in many cases it may have progressed to a certain stage and then have come to a standstill, the toxic factor having been eliminated for the time being. its incipiency is characteristically seen under the posterior capsule as a green and red iridescence, possibly due to a thin flake formation or to a slight separation of the lens from the capsule. Its extension is at first subcapsular toward the equator, and then it progresses forward through the lens substance. The slit-lamp picture at this stage is most characteristic: a porous asbestos-like change. Here and there one may see flat vacuoles. When the cataract is quite advanced posteriorly, similar iridescent incipient changes may be seen subcapsularly at the anterior pole of the lens. Owing to its central (polar) position, even a moderate involvement may greatly reduce visual acuity. The vitreous, as may be seen with the slit-lamp, is more fluid.

There is no doubt that this cataract is due to an absorption of matter toxic to the lens. The anterior capsule of the lens at the pole at this time of life is about five times as thick as is the posterior capsule, and, in addition, is covered by a protective layer of epithelial cells of equal thickness. The greater permeability of the capsule at the posterior pole, therefore, predisposes that area of the lens to these toxic changes.

A similar type of posterior subcapsular cataract is known as saucer-shaped posterior cataract (hinterer Schalenkatarakt). Vogt sharply differentiated this from cataracta complicata. I see no anatomic reason for classifying it among the purely senile types of cataract. Meesmann, in speaking of it and of cataracta complicata, said that the clinical slit-lamp pictures show some similarity.

I think it reasonable that one may accept it as a toxic cataract in a person whose lens cortex is more sclerosed and therefore less permeable to the toxins. This would account for the sharper anatomic delimitation. At least no harm is done in looking on it with this suspicion. Lenses presenting these posterior subcapsular, possibly toxic involvements are often of the sclerosed type. Many have reddish nuclei.

The characteristic slit-lamp evidences of the incipience of toxic cataract give ample warning. A therapeutic elimination of the constitutional toxic factor that may be the cause of these cataracts will inhibit their progression.

UNRECOGNIZED MAGNETIC INTRA-OCULAR FOREIGN BODIES AND THEIR LEGAL ASPECTS *

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AND
ETTA C. JEANCON, M.D.
LOS ANGELES

Two recent legal decisions relative to unrecognized magnetic intra-ocular foreign bodies clearly define the degree to which improvement in medical knowledge and skill creates a corresponding responsibility and legal liability.

In the case of Kosal v. Boyce, 201 N. W. 757, decided by the Supreme Court of Wisconsin in 1925,[1] the plaintiff-patient was struck in the eye by part of a steel spring. The defendant-physician, who specialized in diseases of the eye, ear, nose and throat, treated the injury. According to the record, this physician examined the eye by the use of the ophthalmoscope, direct illumination and oblique focal rays, but failed to discover any foreign body in the eye. Several months later another physician, with the aid of roentgenograms, discovered a piece of steel in the eye. The plaintiff brought suit, and the lower court awarded him damages to the extent of $2,000. The Supreme Court of Wisconsin, to which an appeal was taken by the physician, said that the mere fact, standing alone, that the physician failed to locate the foreign body in the eye by the use of the ophthalmoscope did not necessarily indicate that the physician negligently used that instrument. The court, however, said that the evidence justified the finding that he was negligent in failing to use the roentgen rays, although the testimony indicated that the employment of the roentgen rays is infrequent, these rays being used in only from 2 to 4 per cent of the cases of injuries to the eye. The judgment against the physician was affirmed by the Supreme Court, conditioned on the patient's accepting $500 in lieu of the $2,000 awarded by the lower court, because he was entitled to damages only for the pain and suffering sustained as the proximate result of the defendant's negligence, this element of damages not being compensable under the workmen's compensation act.

In the other case, Lippold v. Kidd, 269, p. 210, decided by the Supreme Court of Oregon, 1928,[2] the patient injured his eye and employed an eye specialist, the defendant, to attend the injury. The latter made an examination, found only a small foreign body in the eye, bandaged the eye and subsequently gave the plaintiff six or seven treatments. Seven months later, the patient consulted other specialists, who discovered a piece of steel in the eye. They were unable to remove it with a magnet, and subsequently the removal of the eyeball was necessitated. The patient brought suit against the specialist who first attended

* Submitted for publication, April 18, 1930.

1. Roentgen-Ray Examination of Eye Required—Damages: Kosal v. Boyce (Wis.), 201 N. W. R. 757, abstr., J. A. M. A. **85**:219 (July 18) 1925.

2. Failure to Discover Foreign Body in Eye—Lippold v. Kidd (Ore.), 269, p. 210, abstr., J. A. M. A. **92**:1792 (May 25) 1929.

him, and the lower court gave judgment against the specialist. The Supreme Court of Oregon, in discussing the case, said that the evidence tended to show that the physician failed to use roentgen rays and that the patient testified that this specialist failed to make an examination of the interior of the eye with the ophthalmoscope. These facts, the court said, established a prima facie case of negligence, but evidence was lacking to show that this negligence was the proximate cause of the removal of the eye.

The court reasoned that if the foreign body had been discovered and an attempt made to remove it, the eye might have been lost in that event; therefore, the evidence did not show that failure to discover the foreign body, even though it may have constituted negligence, was the cause of the loss of the eye. Since it was necessary that this causal connection between the negligence of the physician and the injury to the patient be established before liability attached to the physician, the Supreme Court reversed the judgment of the lower court.

Shasted[3] mentioned a case of unrecognized intra-ocular foreign body leading to the loss or alleged loss of an eye, which formed the ground for a successful claim for damages. He also reported another case in which the patient's refusal to have an x-ray picture taken protected him from a suit after a metallic foreign body had been removed later from the injured eye.

The legal head of one of the outstanding medical protective companies recently said:[4]

It seems peculiar that there are not more decisions involving this proposition. We are constantly defending cases involving the question, and only recently we had a similar case tried in San Francisco with a verdict returned for the plaintiff. The court granted a new trial and hence that case is still pending without any legal decision. . . . The tendency of the courts to hold x-ray pictures necessary wherever applicable is indicated by the recent decisions holding such pictures necessary in diagnosing and checking results in fracture cases. See Rankin v. Mills, California, 278 Pac. 1044 and Taylor v. De Vaughn, California, 266 Pac. 961.

The following report of twenty-one cases of unrecognized intra-ocular foreign bodies seen in our private practice within three years, several of which were actionable, is evidence that such cases are by no means rare. Other ophthalmic surgeons with whom this matter has been discussed have had similar cases in their practices and corroborate our opinion that this situation is more common than would seem possible. The obvious remedy is to call attention to the condition and to its legal liabilities.

THE LEGAL OBLIGATIONS OF SPECIALIZED PRACTICE

There are no specific legal rules, at present, whereby the liability of a physician who fails to discover a metallic foreign body in the eye of his patient may be determined. The law imposes on specialists

3. Shasted: American Encyclopedia of Ophthalmology, Chicago, Cleveland Press, 1917, vol. 10, p. 7183.

4. In a personal communication to the authors.

in such cases the duty of exercising that degree of reasonable and ordinary care, skill and diligence customarily exercised by other specialists in the same line under similar circumstances, at the same time and in the same or similar localities. A specialist or one who, in effect, holds himself out to be such is held to the exercise of more skill and to the possession of more knowledge than a general practitioner.[5] Shasted,[6] in his admirable "Legal Relations of Ophthalmology," stated that certain lower courts have attempted to establish a higher standard of professional knowledge and skill expressed as "such skill and diligence as are ordinarily exercised by thoroughly educated physicians and surgeons." No court of last resort recently has sustained this rule, but the tendency is for the courts to approximate this high standard of medical and surgical requirements more and more closely, keeping pace with the improvement in medical education. The Supreme Court of Missouri long ago stated[7] that there may be responsibility where there is no neglect, if the error of judgment be so gross as to be inconsistent with that degree of skill which it is the duty of every surgeon to bring to the treatment of a case, according to the standard indicated. It is generally known that there are no legal consequences for failure to cure either in general or specialized practice.

In ophthalmic practice, the ocular condition must have been incorrectly diagnosed and the patient improperly treated or neglected in order that this should be constituted malpractice, but damage of some sort actually must have resulted from such unskilfulness or neglect before a patient is entitled to recover. If no damage has occurred, this situation, styled legally, "wrong without damage," is not actionable. The terms "skill and learning" always refer to the current state of medical knowledge. Further, as there must be some standard or measure of what constitutes correct treatment in a given case, the court has said[8] that when a particular mode of treatment is upheld by a consensus among the members of the profession it should be followed by the ordinary practitioner. The same application holds in specialized practice.

A final legal ruling in medical cases, that one's best judgment is to be used in a given case when one is beset with unusual conditions, often provides a just means of protection for the harassed surgeon. This ruling has been a boon to many great surgeons who, because of their wide repute, have a high proportion of the hardest, the most inveterate and the most dangerous cases. The "jealousy, malice or carelessness of their fellow practitioners" usually are at the base of such suits.

5. Beach v. Chollett, Ohio, 166, N. E. 145.
6. Shasted (footnote 3, vol. 9, p. 7160).
7. West v. Martin, 31, Mo. 375, 1861.
8. Jackson v. Burnham, 20, C. Col. 533.

On the other hand, codes of medical practice never were intended to cloak incompetency any more than codes of medical ethics and conduct were designed to that end. All medical codes have the final object of protecting the sick and suffering persons who place themselves in the care of physicians. The mistakes which all physicians make must temper their judgments of the mistakes of others, but legally, gross negligence, gross lack of skill or the violation of clearly held principles of practice may not be condoned, because they violate the rights of the patient.

To practice a specialty in medicine properly a physician must assume the full responsibility and liability for each patient along the lines of the given specialty. He must make the proved facts of this specialty his own and must be able to apply them with reasonable skill. The law generally makes only just demands, although the presentation of the facts in court nearly always is hampered by the astounding rules of evidence.

DIFFICULTIES IN DIAGNOSIS

A small volume might be filled from the literature by the relation of unusual instances of justifiable error in the specific matter of not recognizing metallic foreign bodies in the eyes. Thin, sharp flakes of metal have passed through the upper or lower lids into the globe or have entered by way of the sclera, leaving too fine a wound or scar to be recognized save after a most painstaking search, and often without involving the anterior segment. Penetration of the eye by foreign bodies may be merely one of a number of more obvious injuries, the more dramatic properties of which delay the recognition of this actually more vital injury. No. 9 of our series was such a case; in a motorcycle accident concussion of the brain masked the penetration into the lens of one eye of a flake of enamel. The true situation was not uncovered until a year later when a tiny corneal scar, with a corresponding hole in the iris and a traumatic cataract, led to the evidence, in spite of negative results in examination by means of the x-ray. One of the features of injuries of this kind is the unexpectedness of their relations. No accident appears too trivial or too improbable to provide a background for such an injury. A cook, in case 8 of our series, dropped a metal spoon into a dish of hot gravy and considered the symptoms, arising from a fragment of copper within the eye, as the result of a splash of the hot liquid. Our own conclusions, drawn from a varied experience of several thousand foreign bodies about and in the eyes, are: that one must be on the alert unceasingly for this situation; that it must be considered in every case in which the patient's eye has been exposed to injury and in which a condition of frank disease does not exist, and that every suspicious case

must be studied by all possible modern means. The old ophthalmoscope with dry cell batteries should be replaced by the modern electric ophthalmoscope with its clear illumination, and every injured eye should receive a systematic, routine examination of the lids and globe, the slit-lamp being used when indicated and the x-rays unfailingly and outstandingly in every case in which there is the least doubt.

THE PLACE OF THE X-RAYS IN DIAGNOSIS

This question of the use of the x-rays seems to be the great stumbling block and the crux of the whole matter both medically and legally. To state, as was done in the first decision quoted, that "the x-ray is used in only from 2 to 4 per cent of eye injuries," apparently was merely an attempt to cloud the issue. It is, and for at least twenty years has been, the accepted practice among practically all qualified ophthalmic surgeons to use the x-rays in all cases in which there is the least doubt of the presence within the eye of a metallic foreign body. This has become so inflexible a fundamental rule that it should not be necessary to labor the point, but the matter should be placed once and for all beyond question. It is well known that failure to diagnose the lesion is responsible for most of the later disasters that follow injuries of the eyes. Alsen [9] showed that 39.3 per cent of injured eyes treated on the day of injury retained a visual acuity of one-third and only 17.4 per cent required enucleation, while only 12 per cent of those first treated from five to fourteen days after injury retained this amount of vision and 31 per cent required enucleation. It is of the greatest importance, therefore, to determine clinically at the earliest possible time whether an injury to the eye is complicated by the retention of a foreign body. Before the advent of aseptic surgery, the removal of an eyeball containing a foreign body was considered imperative because of the risk of sympathetic ophthalmitis. Until the introduction of the magnet test or sideroscope and the removal of magnetizable bodies by magnet, such injured eyes were enucleated. The early use of the magnet for diagnosis often was extremely painful and destructive. The means of internal examination of the globe were poor in those days, illumination was bad, and many cases of foreign bodies in the eye were overlooked, particularly those in which the foreign bodies were nonmagnetic and those in which there were hyphemia, gross traumatic cataract, hemorrhage into the vitreous and like obstacles to visual diagnosis. A definite diagnosis was impossible in many, if not most cases, until the application of a knowledge of the x-rays to this problem by F. H. Williams of Boston in 1896, which soon was followed by the development of remarkably accurate methods

9. Alsen: Klinische Erfahrungen über Augenverwundungen, 1913.

of localization. The use of the x-rays in the diagnosis of doubtful cases was said by Nance in 1912 to have been well and generally established among ophthalmic surgeons worthy of the name, and the literature between 1896 and 1914 shows how generally this measure had been adopted.

Intra-ocular foreign bodies occurred in such relatively great numbers during the World War that conclusions as to their diagnosis, their removal and the treatment for the associated conditions shaped themselves more definitely than ever had been possible in civil practice. One of us[10] in 1916 stated: "No intra-ocular search for a foreign body is justifiable without a careful roentgenographic study of the eye from different angles." By the second year of the war, the use of the x-rays for diagnosis and localization was adopted as a routine, save under severe pressure of battle; then general surgical radiography usually was given right of way. It was found, in general, that small fragments of metal rarely penetrated deeply into the orbit, since they expended their energy in piercing the lid and sclera, and usually lodged in the globe, where about 75 per cent of all intra-ocular foreign bodies came to rest in the vitreous. The routine use of the x-rays in injuries of the eyes incurred in battle showed the unexpected presence of foreign bodies within the eyes with surprising frequency, and this was one of its outstanding lessons to civil and particularly to industrial practice, in which this particular form of injury is more productive of economic and insurance loss than any other single lesion.

The x-rays undeniably are the most reliable means for the detection of the eyes incurred in battle showed the unexpected presence of foreign bodies in the globe or orbit is the most important use of this agent in ophthalmology today. The information thus gained aids the surgeon considerably in his choice of operation. The use of the x-rays has become so generalized in internal medicine that there is wide popular acquaintance with the functions of the x-rays, and their use is rather expected. No insurance company ever denied the employment of the x-rays in any suspicious case of intra-ocular injury, nor can the question of the expense ever be considered when balanced against the possible loss of one or both eyes. The few cases in which it has been impossible to demonstrate foreign bodies in the eye by means of the x-rays in the face of clinical signs of their presence have been seized on occasionally as a means of excuse for the lack of their routine use in suspicious cases. The human element involved in the interpretation of x-ray plates always will be defective until man reaches the stature of the angels. Only in the rare cases of complete or nearly complete oxidization of fine steel fragments, is it impossible to demonstrate these

10. Military Surgery of the Eye (footnote 3, p. 7755).

Case and Patient	Time Elapsed Since Injury	Manner of Injury	Previous Treatment	Ocular Lesions					Visual Acuity	Results of Examination by Means of X-Rays	Operation	Results of Operation
				Cornea	Iris	Lens	Vitreous	Retina				
1 F. J. C.	3 yr.	Grinding steel	Intra-ocular body supposed removed three years ago	Scar of penetration	Iridocyclitis, and metal fragment on margin of iris	Clear	Clear	Normal	6/60	Confirmation	Forceps extraction	Round pupil; vision 6/4
2 G. S.	11 mo.	Hammering automobile metal	For supposed foreign body of cornea	Linear scar 2½ mm. long	Paresis of pupil	Opaque cataract; siderosis	Slight opacities	Negative	Light projection	Foreign body localized in vitreous	Removal of cataract; giant magnet extraction	Vision 6/10; detachment of retina in six months
3 D. S.	10 mo.	Hammering metal pipe	For foreign body of cornea	Linear scar 1½ mm. long	Paresis of pupil; iridocyclitis	Cataract; siderosis	Not seen	Not seen	2/60	Negative three times	Enucleation for sympathizing inflammation	Other eye saved
4 J. E.	11 days	Hammering steel	For contusion of globe	No scar found	Mild iridocyclitis	Clear	Clear	Normal	Movement of hands	Foreign body localized in scleral wall	Unsuccessful attempt at magnet extraction	Vision 6/6; no symptoms for two years
5 G. L.	1 day	Fitting bearing	For foreign body of cornea	Linear wound at limbus	Hyphemia	Clear	Funnel-shaped hemorrhage	Linear scar of exit	6/7	Foreign body localized in scleral wall	Unsuccessful attempt at magnet extraction	Vision 6/5; no symptoms after 2½ years
6 O. S.	2 days	Building metal staircase	No diagnosis	Linear wound of cornea	Small tear of iris	Wedge-shaped opacitiy	Clear	Normal	6/15	Foreign body localized in vitreous	Posterior sclerotomy; magnet extraction	Vision 6/7+3; cataract progressive
7 G. W.	11 mo.	Hammering iron bolt	For foreign body of cornea	Small scar near limbus	Paresis of pupil; tear of iris	Dense cataract; siderosis	Vitreous haze	Macular degeneration	Light projection	Foreign body localized in vitreous	Magnet extraction; cataract extraction later	Vision 6/15 and reading of Jaeger's test type no. 5; macular degeneration
8 J. E. H.	13 days	Dropped metal spoon	For burn of cornea	No scar found	No injury	Fine nuclear opacity	Fine vitreous opacities	Exudate in macular region	6/60	Foreign body localized in vitreous	Copper extracted from vitreous by forceps	Light perception
9 A. H.	1 yr.	Motor cycle collision	For concussion of brain	Fine corneal scar	Small hole in iris	Dense cataract	Not seen	Not seen	Light projection	Negative	Removal of cataract extraction of metal in lens	Vision 6/5; central pupil
10 F. K.	5 days	Hammering automobile metal	For abrasion of cornea	Linear scar 3 mm. long	Tear of iris	Leaf-shaped opacity	Clear	Normal	6/20	Foreign body localized in vitreous	Magnet extraction; later cataract extraction	Vision 6/12 and reading of Jaeger's test type no. 2

11 H. A.	14 mo.	Hammering iron pipe	For abrasion of cornea	Linear scar near limbus	Paresis of pupil; atrophy; hole in iris	Cataract; siderosis	Fluid vitreous	Deep glaucomatous cup	Blind; secondary glaucoma	Foreign body localized in vitreous	Unsuccessful attempt at magnet extraction	Enucleation for beginning sympathetic ophthalmitis
12 W. W. B.	10 mo.	Cutting steel bolts	For foreign body of cornea	Crescentic scar near limbus	Tear of iris	Cataract; siderosis	Normal	Normal	6/60	Foreign body localized in vitreous	Magnet extraction; later cataract extraction	Vision 6/5; followed in four months by retinal detachment
13 D. L.	21 days	Hammering steel pin	For foreign body of cornea	Scleral wound near limbus	Discolored iris	Clear	Heavy opacities	Macular degeneration	4/60	Foreign body localized in vitreous	Giant magnet extraction; posterior sclerotomy	Vision 6/60 and reading of Jaeger's test type no. 11; paracentral scotoma
14 S. P.	3 days	Cold chiseling	For traumatic conjunctivitis	Wound at limbus	No injury	Clear	Clear	Negative	6/6	Foreign body localized in wall of eye	Magnet extraction; posterior sclerotomy	Vision 6/5; normal funetion
15 R. S.	2 days	Steel chips blown by compressed air	For subconjunctival hemorrhage	Wound at limbus	No injury	Clear	Clear	Wound in retina	6/6+	Foreign body localized in vitreous	Magnet extraction; posterior sclerotomy	Vision 6/6+; normal function
16 G. O.	1 wk.	Hammering steel	For foreign body of cornea and systemic iridocyclitis	Corneal wound	Small tear in iris	Uncertain	Vitreous abscess	Not seen	Light perception	Foreign body localized in chorioretina	Magnet extraction; later cataract extraction	Vision 2/60 and reading of Jaeger's test type no. 12 from obstruction left by vitreous abscess
17 A. C.	2 days	Drawing nail	For contusion of globe	Linear slit at limbus	Dialysis of upper third	Cataract	Diffuse hemorrhage	Not seen	Light perception	Foreign body localized in vitreous	Magnet extraction; later discission	Vision 6/7+3 and reading of Jaeger's test type no. 2
18 T. M.	3 days	Grinding steel	For corneal abrasion	Central triangular wound	No injury	Capsular cataract	Clear	Metal in chorioretina	6/20	Foreign body localized in chorioretina	Unsuccessful attempt at magnet extraction; enucleation	Two attempts before enucleation
19 A. D.	11 mo.	Laying pipe	For abrasion of cornea	Crescentic corneal scar	Discolored	Opaque cataract; siderosis	Normal	Negative	Light projection	Foreign body localized in vitreous	Cataract extraction	Steel never found; vision 6/20 and reading of Jaeger's test type no. 6
20 R. B.	3 wk.	Hammering spike	For abrasion of cornea	Scar at limbus	Spastic pupil	Diffuse opacities	Marked opacities	No details	6/20	Foreign body localized in vitreous	Magnet extraction; posterior sclerotomy	Vision 6/60; partial detachment of retina in one month
21 M. E.	3 mo.	Hammering steel tap	For abrasion of cornea	Central linear scar	Spastic pupil	Cataract; metal in lens	Clear	Normal	6/60	Foreign body localized in lens	Cataract extraction; metal in lens	Still under care

bodies. This complete oxidization may have occurred in case 3 of our series, in which a thorough search, after enucleation, was made in vain both by inspection of the eye and by examination of x-ray pictures. Misinterpretation is possible when a thin scale of metal is placed in the shadow of dense bone. Sweet reported two failures to recognize fine fragments concealed by the superposition of other shadows, as opposed to 395 cases in which the injured eye was proved to contain foreign bodies. Black and Haessler [11] reported two cases, one being a case of probable disintegration of a small fragment of steel. Our own experience of nearly a thousand penetrating injuries confirms this almost miraculous accuracy and dependability of present diagnosis and localization by means of the x-rays, regardless of hyphemia, traumatic cataract, vitreous disorganization or hemorrhage or retinal detachment. Only when fragments are localized in the scleral wall is there doubt, and we have adopted the routine of considering these uniformly as intra-ocular, trying for them gently, and if unsuccessful, considering them as actually in the sclera but advising the patient as to the full measure of danger.

The fact that occasionally the lens tolerates foreign bodies as well as do other epithelial structures, and the fact that occasional metallic fragments remain in the fluids and walls of the eye for long periods with little or no reaction, while adduced at times to palliate individual carelessness or negligence, have nothing to do with the subject in question. Every metallic foreign body within the globe is a potential source of loss of this eye and possibly of the other, and by no manner of wizardry can the rare fortunate cases be anticipated.

It is our opinion, derived from experience with all manner of penetrating ocular injuries, that improved methods of diagnosis and operative technic, with the present nearly complete mastery of beginning intra-ocular infection, give such favorable results in this form of injury that the prognosis in these cases should be rewritten. Few of these eyes should be lost from causes other than late contractures of the vitreous body or late detachment of the retina or so great laceration and rupture of the globe that recovery with practical vision is impossible from the start. Accurate diagnosis, immediate operation with a gentle hand, serum, diathermy and deep light treatment on the first suggestion of infection will save the great majority, with surprising visual function in most.

The twenty-one cases of unrecognized, intra-ocular foreign bodies tabulated were seen by us within a period of three years. All the patients had been treated by eye, ear, nose and throat specialists, if

11. Black, N. M., and Haessler, F. H.: Metallic Intra-Ocular Foreign Bodies not Demonstrable on Roentgenograms, J. A. M. A. **93**:1043 (Oct. 5) 1929.

this appelation now is correctly used of physicians whose medical interests are so greatly diversified. All but one of the patients had been considered as having superficial injuries. Definite wounds or scars of penetration were found in nineteen. X-ray pictures were made in all cases, and the observations confirmed the ophthalmoscopic pictures of manifest intra-ocular injury in nineteen patients, in all of whom the foreign bodies were localized. Histories accompanied eighteen patients, and the main causes that led to the overlooking of wounds of penetration and the pathways of the missiles into or through the iris, lens and vitreous appeared to be poorly taken histories, lack of routine methods of examination and "snap" diagnoses, based on hurried and superficial inspection. There was every justification for having missed the diagnosis in cases 1 and 9.

Fifteen of the injured men were of average intelligence or better, and the facts involved in their misfortunes were fairly clear to them. Those in whom a good result was finally obtained, in terms of visual acuity and function had no particular feeling against the physicians who had first treated them, but several of the men who lost serious amounts of vision or suffered enucleation after months of discomfort and failure to recognize the condition required all the diplomacy and tact of which we were capable in order to keep them from instituting suit. They were embittered against the whole medical profession, and they were won from this position only by our calculated explanations and by an attitude on our parts of sympathy and understanding of the problems both of the patients and of the physicians involved. Loyalty to the ideals of our profession and a quickened sense of our own inadequacies warranted this course, which, however, was not always easy to maintain in the uncertain stream of human emotions and in the face of gross carelessness or actual negligence.

The lawyer of one of these injured men, who, in our opinion, had a clearcut case of medical and legal negligence with actual damage arising therefrom, met our refusal willingly to testify for his client with the remark: "You medical men seem to think that your support of each other, right or wrong, comes before the rights of those whom you have accepted as your patients. How can you square this evasion of your responsibilities with the obligations to these patients which your own code of ethics demands? As a profession you seem to be unaware that there is a new order in the administration of justice and that this professional barrier, which shuts off access to truth and defeats justice, has been one of the reasons for the movement to appoint unprejudiced medical experts." This opinion, honestly and somewhat widely held among better lawyers, is evidence of changing conditions that should have the consideration of our profession.

SUMMARY AND CONCLUSIONS

1. Intra-ocular foreign bodies are unrecognized more frequently than is supposed, owing to poorly taken histories, lack of a routine systematic examination of all injured eyes and, outstandingly, failure to use the x-rays for diagnosis.

2. No accident is too trivial or too improbable to be the cause of such injuries, the unexpectedness of the causal relation being a feature.

3. Recent legal decisions are to the effect that failure to use the x-rays in the examination of an injured eye found later to have contained a foreign body constitutes negligence.

4. As the picture taken by means of the x-rays is our most dependable means for the detection of foreign bodies within the eye, this ruling accords with long accepted and established ophthalmic practice.

5. Prompt diagnosis and operation and the near-mastery of beginning intra-ocular infection have so improved the prognosis in cases of magnetic foreign bodies in the eyes that good vision and function should result in the great majority of these cases.

VERNAL CATARRH

REPORT OF A CASE TREATED BY RADIUM *

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History.—G. S., a boy, aged 12, reported at the eye dispensary at the Presbyterian Hospital in May, 1929, giving a history that two years previously his eyes had become irritated, with sufficient secretion to glue the lids in the mornings and with some lacrimation. He had had some hospital treatment but without improvement.

The vision was 6/12 in the right eye and 6/9 in the left. The tarsal conjunctiva was roughened, and in the upper lid there were large granulations typical of vernal catarrh. They were so large that pressure had flattened them out, giving them the appearance of a tessellated pavement; there was also some involvement of the pericorneal tissues, and the conjunctiva had a milky appearance.

Treatment.—Dr. H. B. Wilmer was asked to see him to make the allergic test, and the patient was found to react positively to dandelion and timothy, but as these tests were not completed until early in July, it was felt that it was too late for injections of the serum to be used that season.

Cultures isolated *Staphylococcus albus,* and the patient was given some vaccine without relief. Astringent lotions proved of no benefit, and in October, Dr. Newcomet was requested to use radium. This was done. On October 9, a 12.5 mg. needle on a handle was held in direct contact to the right eyelid for twenty minutes, the radium being in a Monell shell 0.2 mm. in thickness. An application was made to the left lid early in November, and shortly afterward another to the right lid, with decided improvement. The granulations disappeared but left the lines of demarcation across the conjunctiva. The boy is symptom-free. Vision has improved to 6/6 in each eye.

In 1918, Shumway showed a similar case before the Section of Ophthalmology of the College of Physicians of Philadelphia, in a boy, aged 11, from the eye clinic of the University Hospital, where he was first seen in 1911. Eleven treatments of one hour's duration had been given to the eyelids, 11 mg. having been used with no results. In February, 1917, radium treatment was again used, five applications being made to the left and four to the right eye within a period of four months. The amount given varied between 35 and 50 mg. After this, the granulations disappeared.

It was believed that the first application failed because of the small amount of radium that was used, and yet it was practically the same amount that was so effective in the case herein reported. It seems possible that reaction is different in different cases. In the case reported the result was most satisfactory with a small dosage.

* Submitted for publication, April 14, 1930.

TREATMENT

Other than cold applications and occlusion of the eyes, innumerable remedies have been tried. Among those enumerated by DeSchweinitz as having been advocated by various authorities are the following: (1) application of boroglyceride to the everted lid; (2) epinephrine, 1:10,000, to which was added 1 per cent solution of phenacaine, N. N. R.; (3) solution of sulphate of quinine; (4) from 1 to 2 per cent aqueous solution of sulphonated bitumen, N. F.; (5) salicylic ointment or massage with yellow oxide ointment; (6) electrolysis; (7) excision of granulations and limbus hypertrophies; (8) collyrium of antipyrin 10 per cent, and instillations of 2 or 3 per cent, strong silver protein, and (9) a 15 per cent solution of the double salt of thiosinamine and sodium salicylate. This remedy was suggested by Luedde and seems to have given exceptionally good results.

This treatment is applied as follows: A 2 per cent solution of phenacaine is instilled. The lid is everted and painted with a 1.5 per cent solution of nitrate of silver followed after its neutralization by application of a 15 per cent solution of the double salt of thiosinamine and sodium salicylate by means of a cotton wound probe, or the solution may be dropped into the eye. This treatment is given every other day. During the intervals a zinc sulphate lotion (0.25 per cent) is used freely.

Secondary nasopharyngitis is treated by suitable sprays, etc. Astringent washes are used as a prophylactic, and on bad days only near work should be permitted. Arsenic administered internally is said to be of benefit. Several writers have reported good results from intravenous injections of calcium chloride urea. Three injections of 10 cc. of a 10 per cent solution with one day intervals are recommended. In stubborn cases tarsectomy may be resorted to.

Gonzales found x-rays of benefit. He used those of a hardness of 6 to 7 on the Benoist scale and of an intensity of not over 5 Holzknecht units (equivalent to tint B Sabourraud-Noiré Pastille) for not more than eight minutes. In seven cases he obtained marked improvement and in one case complete cure.

It is generally agreed that dosage of radium can be more accurate than that of x-rays, and that it is the best remedy known at present. Some ill effects, such as loss of eyelashes and eyebrows and lesions of the conjunctiva and cornea have been reported, but these seem to be due to prolonged application and overdosage. In some cases, the eyelashes fall out but grow in again later.

Shumway emphasized the fact that radium is advocated only in severe cases. He cocainizes the eye, everts the lid and applies radium element (35 to 50 mg.) to the exposed surface enclosed in an aluminum tube 5 mm. thick. This application is made every four weeks. In stubborn

cases removal to a cool climate may be of help. Intravenous injections of salts of rare earths have been found of benefit in some cases.

Riggins applies radium tubes containing from 12.5 to 25 mg. evenly over the affected area for a period of from eight to eighteen minutes. The tubes are not screened and are held by forceps to protect the operator. The reaction is mild and subsides in a few days. Redness of the conjunctiva becomes less marked, and the granulations undergo a process of retrogression.

Burning and lacrimation are noticeably improved in from ten to fourteen days. If too great a reaction is produced, cataract, glaucoma, atrophy of the iris or destruction of the eye may result. Riggins stated the belief that radium acts in these cases by causing a mild endarteritis of the blood vessels and exudative granulations of the eyelids, which in turn cause a retrogressive change in the tissue. In other words, a soft. atrophied, flexible scar displaces the excessive epithelial tissue which makes up the condition. He emphasized the importance of not overheating, and said that only a thin screen should be used for the radium.

Cordes and Horner also feel that large, unscreened doses give best results. Capillary tubes of 1.5 cm. are most convenient. An erythema dose is to be avoided. A dosage of from 600 to 700 millicurie seconds will not give a reaction if applied just short of contact and slowly moved back and forth over the lesions.

When screened radium is used, the reaction is due to the penetrating rays, and atrophy and telangiectasis are apt to develop; unscreened radium should not be used in the bulbar type, as it may injure the globe.

In conclusion, I should like to state that vernal conjunctivitis can be relieved with radium in the proper dose. Its use has been favorably reported on by most authorities.

CONTROL OF TEARING BY BLOCKING THE NASAL GANGLION *

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NEW YORK

The intimate relationship existing between the nasal mucosa and tear secretion is apparent to those who have given the matter thought, yet the literature on the subject is meager. My attention was first called to this relationship by the observation that following blocking of the sphenopalatine ganglion some patients complain of a sensation of dryness of the eyes and a relative absence of tears during weeping. It occurred to me to study the pathways of the tear reflex in an effort to find the cause of the mechanism and, if possible, to apply this same blocking of the sphenopalatine ganglion to cases in which one might desire to diminish the total volume of tears; particularly in those cases in which an unsuccessful dacryocystectomy had been performed with stenosis of the nasolacrimal duct.

Mueller [1] gave the tear reflex careful analysis. Although the ganglion cell groups that control tear secretion have not been definitely localized in the brain stem, he felt that they must be near the large multipolar ganglion cells of the facial seventh cranial nerve. It is known that the secretory fibers for the tear gland arise with the roots of the facial nerve from the medulla oblongata and travel with this nerve through the petrous bone to leave the nerve where it forms the knee for the geniculate ganglion and to travel to the sphenopalatine nasal ganglion as the greater superficial petrosal nerve. The bulbar nucleus region for the tear secretion must be close to that of the mucous gland of the nasopharynx, since both glands function fairly synchronously, as is evident in the expression so common in German, "Rotz und Wasserheulen"—mucus and tearing.

From the sphenopalatine ganglion the tear fibers travel by way of the sphenopalatine nerves to the zygomaticotemporal nerve, which joins the lacrimal nerve running to the tear gland.

Gray [2] stated that occasionally the lacrimal nerve is missing and only the zygomaticotemporal nerve supplies the tear gland.

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1. Mueller, L. R.: Die Lebensnerven, Berlin, Julius Springer, 1924.

2. Gray, Henry: Anatomy of the Human Body, ed. 20, Philadelphia, Lea & Febiger, 1928.

As will be seen later, it is important in this connection to consider the physiology of the nasal ganglion. Mueller stated that it cannot be questioned any more that it is a vegetative nerve center; it must therefore be connected with the cerebrospinal nervous system by a white ramus communicans. For this connection between the medulla and the ganglion one can consider only the greater superficial petrosal nerve. The difficulty in establishing this nerve as the white ramus communicans lies in the fact that it is not a simple motor nerve, but proceeds from the facial nerve at a point where the geniculate ganglion is formed.

According to von Lenhossek, the fibers of the greater superficial petrosal do not come into relationship with the cells of the geniculate ganglion, but pass through the ganglion to join the facial nerve as it travels centrally to the medulla.

Since the greater superficial petrosal nerve travels from the cerebrospinal nerve (the facial) to a sympathetic ganglion, it can be looked on as a white ramus communicans.

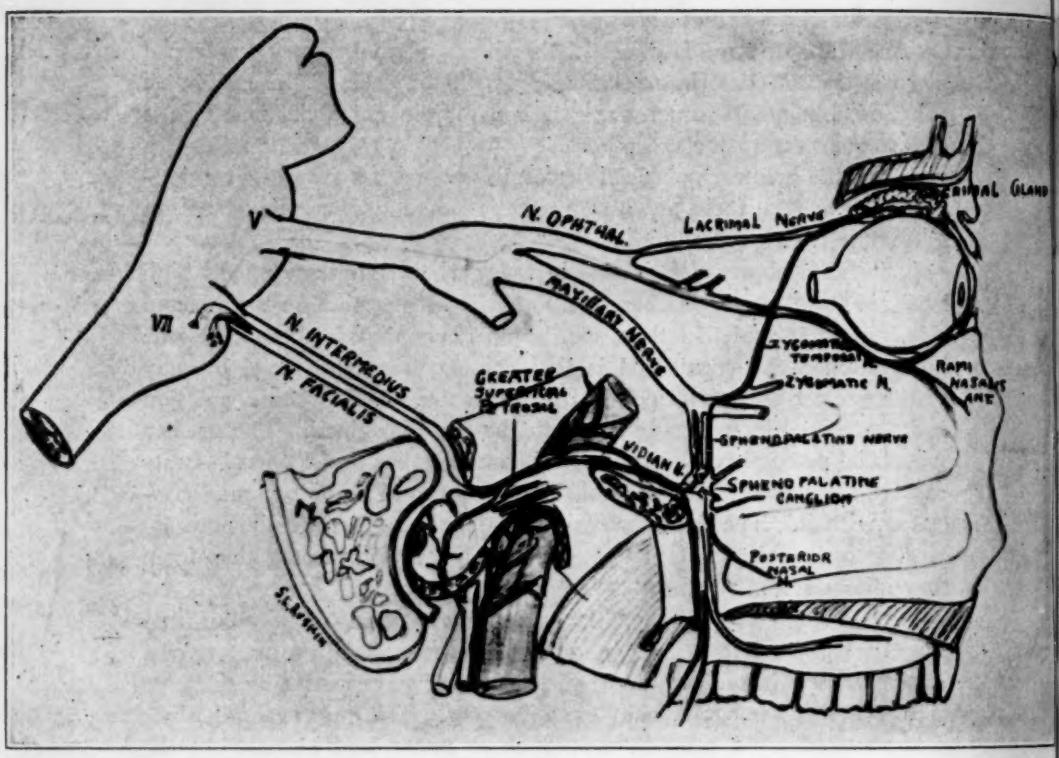
Clinically, observation is also in favor of this conception. In high localized facial paralysis, there is a loss of tear secretion on the affected side. Mueller said that there can be no doubt that in those cases the innervation to be considered is that coming from the facial by way of the greater superficial petrosal nerve to the sphenopalatine ganglion and from here by postganglionics to the lacrimal gland. The greater superficial petrosal contains only myelinated, rather broad fibers. In its passage through the vidian canal the deep petrosal nerve becomes associated with it. The latter comes from the plexus around the internal carotid to the sphenopalatine ganglion. The two nerves together form the vidian nerve.

The histologic picture of the vidian nerve is also typical of that found when a white ramus communicans is mixed with a gray ramus. In the nonmyelinated portion of the vidian nerve, representing the deep petrosal, there are occasionally ganglion cells. The deep petrosal, since it is nonmyelinated, must be a postcellular nerve, and seems to be the connection between the superior cervical ganglion, by way of the carotid plexus, and the sphenopalatine ganglion.

In the histologic studies of Mueller it is definitely shown that the nasal ganglion is exclusively formed of cells possessing many dendrites, and that it is sympathetic. This study makes it certain that from the sphenopalatine ganglion itself no sensory or motor fibers for voluntary muscles can arise. The sensory and motor fibers, however, pass through the ganglion to mix with the postganglionic fibers, so that a blocking at the nasal ganglion can strike sensory, motor and vegetative fibers. One can therefore attribute to the sphenopalatine ganglion proper only such functions as are mediated through the involuntary system, that is to say, glands or smooth muscle, the secretory or the vasomotor function.

Apparently, therefore, the only glands supplied by the nasal ganglion are the tear gland and the mucus glands of the nasopharynx.

Formerly the function of tear secretion was attributed to the trigeminal nerve; to be sure, the lacrimal nerve which arises from the fifth nerve induces tear secretion. But by assuming that the secretion comes from the trigeminal and its nucleus, one is forgetting that a secretory impulse can arise only from a sympathetic ganglion and can travel only through postganglionic fibers. It has been shown experi-



Composite diagram of tear reflex.

mentally that when the trigeminal nerve has been cut at its root, strong sensory stimuli anywhere in the body induces tear secretion. This would be impossible if the secretory fibers traveled with the trigeminal from the medulla oblongata. Such experiments indicate that the vegetative tracts which induce tearing join the lacrimal nerve peripherally. It was pointed out earlier that facial paralysis central to the geniculate ganglion disturbed the tear secretion on that side. The tract for tear secretion must therefore leave the facial in the region of the geniculate ganglion. One can consider the pathway to proceed only through the greater superficial petrosal nerve to the nasal ganglion to be dis-

tributed through the short sphenopalatine nerve to the zygomatic and from here finally, with the lacrimal nerve through the connecting branch, the zygomaticotemporal nerve.

The innervation of the lacrimal gland is not solely from the bulbar autonomic but is also participated in by the sympathetic and the superior cervical ganglion. It has not been determined whether the fibers from the superior cervical ganglion exercise only a vasomotor influence on the tear gland and affect it in that way, or, as is more likely, whether they have a direct secretory effect, probably inhibitory. Likewise it is not definite as to what path is taken from the superior cervical sympathetic to the lacrimal gland. Undoubtedly the fibers run upward by way of the plexus around the internal carotid to encircle either the ophthalmic artery or by way of the cavernous plexus to the first division of the trigeminal and with this to the lacrimal nerve.

This interesting analysis, brought forward chiefly by Mueller, has needed practical demonstration and application. With the introduction of the posterior palatine route for the injection of the nasal ganglion which I described elsewhere [3] came a rapid and easy approach to this nerve structure. The blocking of this ganglion affords a method for the diminution of tear secretion whenever it is excessive. I have already reported a case in which the tear secretion was diminished by blocking the nasal ganglion in a patient with chronic dacryocystitis who had previously been operated on.[4]

I want also to point out that blocking the nasal ganglion does not completely block the tear secretion since the innervation is double, coming from both the cranial autonomic and the sympathetic nerves, but that the total volume of secretion is diminished, which is a great comfort in these cases.

It is interesting also to note that excessive tearing independent of any obstruction to the drainage, that is, an oversecretion of tears, can be observed relatively often in chronic ethmoiditis with or without neuralgia. Especially is this seen in cases in which a chronic sinusitis induces an atrophic rhinitis. Here the drainage may be free, but the tear secretion is distinctly excessive. In the true cases of atrophic rhinitis due to overaction of the vasoconstrictor fibers this manifestation does not occur. In the former cases, blocking of the nasal ganglion is useful.

SUMMARY

The pathway of the tear reflex includes the nasal ganglion. Blocking of the nasal ganglion diminishes the tear secretion.

3. Ruskin, S. L.: Contributions to the Study of the Sphenopalatine Ganglion, Laryngoscope **35**:87 (Feb.) 1925.

4. Ruskin, S. L.: The Sensory Field of the Facial Nerve, Arch. Otolaryng. **7**:351 (April) 1928.

RADIUM IN VERNAL CATARRH*

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Since 1917 my co-workers and I, at the request of several ophthalmologists, have treated with radium, a number of patients with vernal catarrh. This contact with a nonmalignant disease has come about because several years ago radium was reported to be of value in dealing with this condition and because our peculiar facilities made possible the preparation of various types of radium applicators in our laboratories. As favorable reports from radium treatment for vernal catarrh are constantly appearing in the ophthalmologic literature, it seems only proper that I should present our experiences to date. I offer this report at the present time particularly since I feel that certain hazards are attendant on this form of treatment, and that it should not be entered into without an unusual degree of caution.

As for the immediate effects of treatment, it is my impression that the symptomatic improvement is much more marked when radium is employed toward the end of the acute seasonal phases. Consequently the irradiation is apt to be credited with more than is due it, and symptoms are likely to recur with the next seasonal fluctuation. A distinction should be made between clearing up of the granulations and complete eradication of symptoms. It is my belief that in certain instances when the use of radium has accomplished its utmost through clearing up of the granulations, symptoms persist due to the chronic inflammatory changes, and these are mistaken for further direct manifestations of the disease. Consequently, treatment by irradiation is persisted in; this aggravates rather than relieves, and represents serious possibilities later in the case.

The immediate local reaction, on the eyelids as elsewhere in the body, is aggravated by the presence of local infection, and may result in serious complications both immediate and remote, as will be noted from one of the cases to be cited later. Special attention ought to be given to the clearing up of complicating low-grade mixed infection preliminary to any treatment by irradiation.

We have given considerable attention to the technical methods best adapted to the treatment in these cases and are of the opinion that an "active deposit" of radium emanation collected on lead foil offers the best means of application. This preparation of "active deposit" on

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lead foil lends itself satisfactorily to application beneath the eyelids. It is easily cut and molded into the proper shape to fit the patient. It is not bulky, and the foil may be folded over so that protection is accorded the globe of the eye. The quality of radiation is soft and best adapted to the treatment in a superficial area. A concentrated applicator may be prepared in this way so that the actual duration of treatment is but a few minutes, and hence the applicator can be more accurately kept in position. There is an additional advantage, we believe, in making a direct contact application beneath the lids rather than by attempting to evert them, under which circumstances some granulations higher up may be missed, or by attempting to treat through the skin of the lids. In the latter instance a harder quality of radiation becomes necessary, and with it greater risk to the globe of the eye, unless protecting shields are employed between the lid and the globe.

The preparation of this active deposit is tedious, entails considerable extra risk to the technicians in the laboratory and a still greater risk to the hands of the operator in the actual treatment of the patient. It is obtainable only in a laboratory with a large supply of radium and a complete radium emanation plant.

We have attempted to obtain the same practical result through the fixïng of radium emanation glass tubes on wooden or metal applicators with paraffin, but while these afford a proper quality of radiation, they have not been technically as satisfactory and are apt to traumatize the surface to some extent. From a physical standpoint no applicator, applied either close to the surface or at distance, should be employed externally over the skin of the lids, even though the globe is protected by a shield under the lid. The quality of radiation from such a heavily filtered applicator is not that best suited to the treatment of soft granulations on a superficial and curved surface. The skin of the lid and the eyelashes are apt to be damaged by the amount of radiation necessary to influence the granulations, and finally it is impossible to avoid completely an extra hazard on the part of the globe of the eye.

The nearest approach that we have been able to make in a simpler applicator for direct contact application has been by the collection of a large amount of emanation in a small glass sphere mounting this, in turn, in a small protective metal cup with a flexible handle and with an opening in one side of the cup. With such an applicator the lid may be everted, the globe protected with a shield, and radiation of proper quality applied directly to the granulations by contact. It is not as satisfactory as the active deposit, however, and can scarcely be applied as uniformly, particularly along the upper margin of the involved area. In all instances of application the eye is, of course, cocoainized and the ocular conjunctiva protected by a sterile lubricant.

I would suggest that ophthalmologists might well consider the use of a specially made radium element plaque of proper shape with a suitable handle, which has the radium element fixed on its concave side by a shellac or other fixing medium which would afford light filtration only, thus insuring a proper quality of predominantly beta radiation, and a metal back that would adequately protect the globe of the eye. Under any circumstances the danger to the hands of the operator is considerable, and it is for this reason that we are opposed to the handling of these cases in our institution.

The responsibilities are in the direction of treatment for the neoplastic rather than the inflammatory diseases, and we do not feel justified in exposing our workers to an unusual hazard in a group of cases outside this special field, particularly when there is rather limited working space and there are other, and I believe, more serious uses for our radium. Our contact with these cases, as previously stated, has been through friends who were specially interested, but we now feel that the responsibility and hazards ought to be assumed by the ophthalmologists directly and not by a department such as ours.

A general review of the cases in which radium treatment has been given is, at best, incomplete. The long drawn out character of the disease, with its symptoms of varying intensity, is not conducive to prolonged, regular attendance of the patients at clinics. The majority of the patients belong in the social class that does not fully appreciate the value of prolonged attendance particularly in the face of symptomatic relief. Since the work does not fall within the sphere of our major responsibilities the follow-up at home by our visiting nurses is not as careful as is our custom in dealing with malignant diseases.

After a few records were discarded in which the evidence was not sufficiently conclusive to form an opinion one way or the other, eighty-two cases remained for analysis. Twenty-two of these were in the open active file and sixty had been closed since the patients had failed to report for further examination after a considerable period of time. Thirty of these patients showed no evidence of active disease and were in every respect free from symptoms at the time of the last examination. The period of freedom from symptoms and clinical evidence of disease ranges from one to nine years. Of this group of thirty patients, nine are still reporting at regular intervals for reexamination while twenty-one have ceased their regular visits at the clinic; twenty-five of the patients show what we might term, "fairly satisfactory" local results; that is, they presented little or no anatomic evidence of disease and only minor symptoms at the time of the last examination. The time interval covered a period of from one to four years. Ten of these twenty-five patients are at present in our active follow-up group and under routine observation, whereas fifteen of the records have been

closed because of failure on the part of the patient to report. Of the cases which had been under observation for more than one year, we have record of two in which there had been a total failure of relief in this period of time. Both of these patients discontinued treatment for obvious reasons.

Of twenty-four patients under our active observation for less than one year, ten showed good results. Three of these are still under observation and seven have discontinued their visits. Seven patients have shown marked improvement both anatomically and symptomatically but not complete clearing up of the disease, and the remaining seven patients ceased treatment at a time when the result to date was unsatisfactory.

Altogether, therefore, in this group of eighty-two cases, we obtained excellent and satisfactory results in forty; improvement, but not complete clearing up of the disease, in thirty-two, and failure in the remaining ten, one of these being due to an acute inflammatory process in an eye treated in the presence of pronounced mixed infection.

Of the large group of patients who have ceased their routine visits to the clinic, it is fair to assume that a considerable number remain well, particularly since twenty-eight of them showed excellent results at the time of their last visit, and twenty-two showed marked improvement when last examined.

In appraising the actual dangers of treatment by irradiation, however, the question as to what has happened to this group ultimately is important, although, unfortunately, I am unable to answer it at the present time.

In the group in which symptomatic relief was only partial, the persisting symptoms were, for the most part, due to the chronic inflammatory changes incident to fibrosis and the influence on the delicate blood supply of the lids rather than to remaining active disease. Further, these chronic inflammatory changes following treatment are most pronounced when treatment has been carried on over a prolonged period of time, that is, at intervals of one or two years or more. There is a vast difference between repeated doses at prolonged intervals and small doses repeated at short intervals, as is the method of some ophthalmologists. The latter procedure is safe as long as the total dosage is not too intense and when that total dosage is attained within a period of a few weeks. Each dose of irradiation results in additional reduction in the capillary blood supply and in additional fibrosis; hence, doses of moderate or greater intensity at prolonged intervals will, with each succeeding dose, produce a more marked inflammatory reaction per given quantity of radiation employed than did the preceding dose. It is particularly important to bear in mind this hazard to the lids and conjunctiva from repetition of treatment over long periods. It seems

difficult to establish an optimal dose as the individual reaction varies a great deal, and as, apparently, the resistance to irradiation varies markedly in different persons. With our "active deposit" on lead foil, which we regard as the most satisfactory method of treatment, it would seem that approximately 300 millicurie minutes for each eye is a safe dose under practically all circumstances. A considerable number of our patients treated by this method and with doses ranging between 200 and 400 millicurie minutes per eye showed no untoward effects. With the other types of applicators one can say only that the dosage should never exceed at most a mild erythema dose with applicators designed for contact application. The various applicators used over the skin surface of the lids are to be condemned in any dosage since unnecessary damage is done to the eyelashes, scarring and thickening of the lids from the quality of the radiation so employed, is excessive, and an unnecessary degree of chronic conjunctivitis is produced.

The greatest danger, however, in the use of radium in these cases is the possibility of damage to the lens. We have seen a few instances of this, and it is for this reason that we consider the use of radium in vernal catarrh particularly hazardous. There seems to be no definite relationship between the dosage employed and the changes in the lens which may occur, as will be seen from a few cases to be cited later.

The review of our cases suggests that adults are more susceptible to damage than younger subjects. It may be that they are normally approaching the age when comparable yet less marked changes are more apt to occur. On the other hand, the fact that the eyes of children seem to be more resistant to the damaging effects of radiation than are those of adults, gives no assurance that certain changes may not occur later as a direct result of this irradiation. Some of the children in our group of improved but not cured patients complain of uncomfortable sensations in the eyes when the chronic inflammatory changes about the lids and conjunctiva are not sufficient, we believe, to account for the discomfort complained of, and yet ophthalmologic examination fails to show an anatomic change sufficient to produce symptoms. It is possible that gross anatomic changes will appear at a later date.

Possibly a few specific examples of unfavorable results that we have had will serve to give a better general idea of the uncertainties attendant on the treatment in any given case.

REPORT OF CASES

CASE 1.—J. B., a man, aged 35, was admitted to the outpatient department of the Memorial Hospital on June 16, 1920. Symptoms had been present for one year, and subsequent treatment had consisted of various local applications and washes. This patient was treated in June, 1920, in March, May and July, 1921, and in August, 1923. All of the applications were by direct contact, except the last, which was in the form of more heavily filtered radium applied externally; only one of the applications, namely, that in May, 1921, was by the "active deposit"

technic. The patient was benefited from the beginning but was not entirely relieved until the latter part of 1923.

He returned to the hospital in 1927 complaining of irritation in the eyes and of failing vision. Ophthalmologic examination revealed a generalized vascular dilatation of the vessels of both the lids and the bulbar conjunctiva with an increased intra-ocular tension. There was a faint opacity of the left cornea and an irregular, diffuse opacity in both lenses. The eyegrounds seemed normal. He showed, in addition, a mottling of the skin of the lids with a loss and whitening of the eyelashes.

For the following two years he was under the constant care of ophthalmologists and was unable to work. After treatment for glaucoma and after operation on the cataracts, his vision was sufficiently restored to permit him to read moderately and to go on with his work.

A review of this as an individual case would lead at once to the conclusion that the patient had been grossly overtreated. I believe that the last application given was poorly chosen. We now realize that repeated treatments over an interval of three years as in this case are unsafe. The following report, however, will give some idea of the variable resistance or response to repeated prolonged application in another person.

Case 2.—H. C., a boy, aged 12, was admitted to the outpatient department of the Memorial Hospital on Oct. 18, 1917. The child's symptoms had been progressive over a period of four years, during which time he had been treated with various local applications and by curetting of the lids. In this respect there was a greater amount of traumatism and counterirritation than in the previous case. He was treated in October, 1917, by "active deposit" to both lids. This was repeated in April, 1918. In April, 1920, a lightly filtered contact application of bare tubes held to an applicator by paraffin, as previously described was used, and in September, 1921, the left eye was treated with the protected sphere or "bulb" of lightly filtered emanation. He improved from the beginning, but was not entirely anatomically and symptomatically free from trouble until after this last application in September, 1921. He presented no symptoms and no anatomic changes after that time, and was apparently perfectly well when last seen. He had a greater amount of preliminary counterirritation to the lids and a greater intensity of irradiation over a longer period than the patient in case 1, yet the ultimate result was perfect in every respect.

Probably the most outstanding case in our entire group is the following.

Case 3.—P. R., a woman, aged 35, was admitted to the outpatient department of the Memorial Hospital on Jan. 19, 1921. Symptoms had been present for ten years with seasonal variations. She had had most extensive and intensive treatment, including curettage of the lids on several occasions, copper sulphate and other local caustics, various sedative applications in order to permit of sleeping and on one occasion minute doses of radium. In addition to large, heaped-up granulations covering the entire surface of both upper lids, she presented marked thickening and the other chronic inflammatory changes usual in such cases. A single application of "active deposit" in lead foil, 300 millicurie minutes in each eye, served to clear up the condition entirely; she was entirely free from it when

last seen. The chronic inflammatory processes about the lids had to a large degree subsided, and there were no anatomic changes within the globe of the eye.

A single case of this sort lends a great deal of encouragement toward treatment by this method, and I quote it to show what may be accomplished in one of the worst cases. However, we have never been able to duplicate completely this one very unusual result.

Another case showing corneal opacities follows.

CASE 4.—J. S., a boy, aged 10, was admitted to the outpatient department of the Memorial Hospital on May 14, 1924. This child had had symptoms for two years, had had six cautery operations and presented a very advanced stage of the disease. He was treated with benefit from the beginning but without complete relief from symptoms and without clinical evidence of disease until the fall of 1927. He received contact applications of the lightly filtered emanation bulb on May 14, 1924, and a light dose of "active deposit" on June 26, 1924. In November, 1924, he was again treated with "active deposit;" another application was made in May, 1925, and a final one in June, 1927. In May, 1928, the child showed a beginning opacity of the left lens and by December, 1928, this opacity had increased somewhat, although he was still attending school without complaint of a visual change.

We have been unable to follow the case during the past year.

The dosage at each treatment in this case was light, but the repeated treatments at long intervals, five applications to the left eye and four to the right eye, were evidently the damaging factors.

The following case indicates the possibility of increased danger in small doses, particularly of more heavily filtered radium, in adults.

CASE 5.—M. H., a woman, aged 45, was admitted to the outpatient department of the Memorial Hospital on July 18, 1923. Her symptoms had been present for twelve years. Treatment had been by local caustic applications from time to time. She was treated by a single application of heavily filtered radium at 1 cm. distance over each lid and with a suberythema dose on July 18. Her symptoms were relieved, and all clinical evidence of the disease had cleared up by fall.

The patient remained under observation, and when last seen had had no recurrence.

In May, 1928, she complained of failing vision, and examination showed cataracts in both eyes. These are still being followed by the ophthalmologist, who is awaiting the proper time for operation.

The question, of course, might be raised in a patient of this age as to how much radium had to do with the development of the cataracts. Our opinion is that it was the determining factor, since we have seen similar developments in comparable quantities of filtered radium used adjacent to the eyes and for other purposes.

Another example of the danger of prolonged applications of radium follows.

CASE 6.—M. U., a boy, aged 11, was admitted to the outpatient department of the Memorial Hospital on Jan. 28, 1920. Symptoms had been present for eight years. In addition to various local applications, the lids had been curetted twice,

and filtered radium in small doses had been used elsewhere on three previous occasions—the fall of 1918, in May, 1919, and in August, 1919. These radium applications were of low intensity but were heavily filtered. He was treated in our service on Jan. 28, 1920, with a very light dose of "active deposit" to each lid. He was benefited symptomatically, but the granulations were particularly stubborn. However, treatment was persisted in partly because of the resistance of the local process and partly because symptomatic relief was experienced following treatment. All of the doses employed were of very low intensity and by contact. Between January, 1920, and August, 1927, eleven applications were made to the left eye and twelve to the right eye. In March, 1928, a beginning opacity of the left lens was noted. This was gradually progressive, and the patient was therefore still under observation at the time of this report.

Another hazard should be noted, namely, the increased dangers of irradiation in the presence of acute infection.

CASE 7.—F. O., a man, aged 29, was admitted to the outpatient department of the Memorial Hospital on July 14, 1925. The symptoms were of twelve years' duration. Various local applications had been used; the cartilages had been removed from the upper lids, and during the previous ten years six roentgen treatments had been given. The fact concerning these treatments were not obtainable. In addition to well marked active disease, there was an excessive amount of scarring of the lids due in part probably to the roentgen irradiation; there was also a pustular infection at the borders of the lids. The patient was treated on July 14, 1925, by "active deposit" on lead foil to each upper lid, 400 millicurie minutes to each eye. The immediate inflammatory reaction became aggravated and persisted, in spite of various local measures employed for its relief. Five weeks after treatment, the patient failed to return to our clinic and we were unable to locate him for some little time. He returned to see us three months later; he stated that he had had some sort of general physical collapse shortly after his last visit to us in August, and that he had been taken to another hospital, where his left eye was ultimately removed. As nearly as we were able to determine by the sequence of events, infection at the borders of the lids, which was present when we treated the vernal catarrh, was aggravated by the irradiation, resulting ultimately in corneal ulceration and a general infection which necessitated removal of the eye.

This case illustrates tragically the damage that may result from employing irradiation to the presence of an acute inflammatory process, particularly about such a delicate structure as the eye.

CONCLUSIONS

I should like to emphasize again the fact that while radium is undoubtedly of great value in the treatment for vernal catarrh, its use may be followed by serious consequences. Since these untoward effects are evidently dependent more on the individual susceptibility of the patient than on anything else, it would seem that radium in vernal catarrh should be used only after all other remedies have been exhausted.

Contact applications of very lightly filtered radium are preferable, and repeated applications of even moderate intensity over a prolonged period of time are unjustifiably hazardous.

DENTAL INFECTION IN DISEASES OF THE EYE*

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The relationship between infected teeth and diseases of the eye has been known for some time. Several centuries ago, Fabricius Hildanus reported a case of ophthalmia and loss of the eye due to an abscessed tooth. In 1795, Richter wrote regarding the connection between dental irritation and diseases of the eye, and in 1817, Bier described a case in which contraction of the visual field was done away with by extraction of a carious tooth. Jonathan Hutchinson reported many cases of defective vision effectually relieved by the removal of pathologic conditions discovered in the mouth. During the past twenty years, the subject of dental focal infection has received much attention, due primarily to Sir William Hunter of Montreal, who first called attention to it in 1910, and to the experimental work of Dr. E. C. Rosenow, of the Mayo Clinic, and the clinical work of Dr. Frank Billings. The last named has defined focal infection as a metastatic, systemic or local condition due to infectious micro-organisms or their toxins carried in the blood or the lymph stream from a focus or foci of infection. A focus of infection is a localized or circumscribed area of tissue containing pathogenic micro-organisms and may be either primary or secondary.

No part of the eye seems to be immune, but the structures that are most frequently involved are the iris, ciliary body and choroid. In these locations there is a gradation from an abundant to a scanty supply of blood and hence a gradation in the supply of available oxygen. Burton Chance described two types of uveitis due to dental infection: (1) acute iritis with extension to the ciliary body, accompanied by intense exudation into the tissues and clouding of the sight—the mouth is usually in bad condition, harboring germs; (2) low grade chronic inflammation with no tendency to exudation; this condition is seen in patients with clean mouths. The roentgenograms in these cases show apical infection.

Kolmer expressed the opinion that these secondary foci, in general, are due to the presence of the organisms rather than to the toxins absorbed from the primary focus, while Hensen held the opposite view,

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because the improvement following the removal of the toxigenic focus is so rapid. Treacher Collins stated the belief that in inflammations of the uveal tract, the aqueous contains both the organisms and their toxins.

The frequency of dental infection can be approximated from a study of the following figures: Lang found 71 of 176 cases, or 40 per cent, due to this cause; Brown and Irons, in reporting on 100 cases of iritis in 1916, 16 per cent; in their second series of 100 cases reported in 1923, 9 per cent; Frederick, 200 cases of iritis, 37 per cent; Back, 50 cases of iridocyclitis, 32 per cent, the condition in only 4 in this series being definitely negative regarding dental observations. In this study all cases in which the patients were suspected of having syphilis or tuberculosis were excluded. Byers, 80 cases of iridocyclitis, 32 per cent; Butler, 100 cases of uveitis, 12 per cent; Benedict, 60 cases of retrobulbar neuritis, 23 per cent; Elschnig, 28 cases of iridocyclitis, 42 per cent; Wendt, 35 cases of iridocyclitis, 40 per cent; only 3 of this series had normal teeth; and Bulson, 100 cases of iritis taken from his private practice, 32 per cent. The French ophthalmologists, Rachon-Duvigneaud, Morax, von Lint and Moreau, at a special meeting of the society to discuss this question, considered the American concept, especially as to frequency, rather exaggerated.

In only one of the foregoing series, that of Back, was the relationship of the side of the dental infection to that of the eye tabulated. In 23 cases of unilateral iridocyclitis, 8 showed dental infection on the same side; 4 on the opposite side and 11 on both sides. In 23 cases of bilateral iridocyclitis, 9 showed unilateral infection; 14 bilateral. In 4 of the 8 cases in which the infection occurred on the same side, the infection was in the upper jaw, in 2 in the lower jaw and in the remaining 2 in both the upper and the lower jaw. The conclusions reached from these observations are that the infection is usually on the same side and that the upper jaw is responsible for more infection than the lower. This is probably due to the fact that caries involves the upper teeth more often than the lower.

As compared with other foci, dental infection ranks first, being followed by the tonsils, intestines, sinuses and the genito-urinary tract in the order named. Gill, of Richmond, claims that oral infection is eight times as frequent as tonsillar infection.

The dental conditions likely to form sources of infection may be grouped under three headings: (1) pyorrhea alveolaris, (2) caries and (3) apical or periapical infection, usually in the form of granulomas of the roots. These consist of a capsule enclosing granulation tissue filled with streptococci, either hemolytic or belonging to the *viridans* group. Of these, the latter is the most frequent and most important. Periapical tissues are infected: (1) by the passage of bacteria and their toxins through the apical foramina of a tooth, with an infected pulp,

consequent on caries as a general rule; (2) by their passage from an infected periodontal membrane via the blood or lymphatic drainage of this structure, and (3) by their passage in the blood of lymph circulations from more remote parts.

The most dangerous forms of dental infection are those of the pulp, pulpless teeth and apical abscesses. They are free from symptoms and hence unsuspected. Being situated in the osseous tissue, no expansion can take place, and their only drainage is into the circulation. They are exposed to pressure transmitted by the teeth during mastication, and as each bite has a pressure of 70 pounds to the square inch, it can readily be seen that a great number of bacteria are forced into the blood stream.

Impacted and ectopic teeth may, at times, give rise to inflammatory conditions of the eye, the infection being hematogenous, but, as a general rule, they produce reflex disturbances.

The method of transmission has long been a debated question, and experimental and clinical observations have not always been in accord. Misch stated the belief that a propagation by way of the lymphatics from a tooth to the eye would always have to follow a round about course through the pre-auricular lymph glands. Birch-Hirschfeld found a system of spaces in the orbital tissue which is to be regarded as a lymph space system, but a communication of the lymph vessels of the orbit with those of the antrum of Highmore, or the other accessory sinuses has, so far, not been demonstrated anatomically. Through the study of numerous microscopic preparations from a case of orbital phlegmon, he is convinced that these spaces serve as routes for the invading leukocytes and lymphocytes. Yet he assumes a thrombophlebitis, phlebitis or periphebitis in practically all cases in which infections are transmitted from the orbit to the meninges, and he opposes the belief of other authors that the processes may spread along the nerve sheaths. Hensen expressed the opinion that the transmission is through either a thrombophlebitis or the antrum of Highmore, the former when the canines and bicuspids are involved, the latter from the molars, and that iritis is probably caused through transmission by way of the lymph channel. Maiden gave four routes of transmission to the eye: by continuity, by way of the blood vessels, by way of the lymphatics and by way of the lymph sheaths of the nerves. Back made the claim that transmission can take place along the nerves, as evidenced by the spread of the virus of herpes from the second branch of the trigeminus to the first. Benedict recognized the following methods of transfer to the eye: (1) directly through bone, the tooth socket becoming the seat of an infection that destroys the bone of the upper jaw and through that directly affecting the orbital walls, finally producing a cellulitis or retrobulbar neuritis; (2) direct extension of the process along the perios-

teum to the malar bone, invading the orbit and giving rise to similar processes; (3) transfer of organisms from the focus at the tooth to the eye by the blood stream.

Of interest in this connection is the experimental work of Rosenow in establishing his theory of elective localization. Latent foci were produced by devitalizing and infecting the teeth in dogs, closely simulating the conditions often induced in persons by dentists. Nephritis, nephrolithiasis and ulcer of the stomach have been produced with cultures isolated from patients with these respective diseases, and in each instance the causal relationship of the organism introduced into the teeth and the metastatic lesion has been established by the demonstration of the organism in the lesion and by the elective localizing power of the strains isolated at the end of the experimental period. Of 66 guinea-pigs given intravenous injections of cultures obtained from dental granulomas of patients having pathologic conditions of the eye, 66.7 per cent had metastatic infections of the eye. Of 189 guinea-pigs given injections in the same manner, cultures obtained from the teeth of persons having no ophthalmic conditions being used, 14 per cent showed metastatic lesions of the eye. Back studied the material in Elschnig's clinic at Prague over a period of three years in order to determine whether he could corroborate Rosenow's observations from a clinical standpoint. Only chronic cases with purulent processes (granulomas) on the apexes of the teeth were included. Fifty-six were examined and cultures made. The usual precautions were taken regarding the extraction, and the granulomas were clipped off with sterile scissors, opened and their contents cultivated. The great majority showed streptococci, but a twenty-four hours culture injected hypodermically into mice produced no results. Fourteen rabbits were given injections with cultures taken from the teeth of patients suffering from iridocyclitis, and in none of them did eye trouble develop. Moody, in his experiments on 78 animals given injections of streptococcic cultures from teeth of patients suffering from iridocyclitis, was able to obtain only 1.7 per cent of positive results. As a result of these experiments, it must be concluded that direct metastasis through the blood does not take place as frequently as Rosenow and his followers have reported. Noyes and Ladd, in a study of the lymphatics of the dental region, made injections with ferric ammonium citrate into the lower canine teeth of dogs. In order to do this, the teeth were trephined, and the fluid was injected through the dental tubules into the pulp chamber. It was shown that the fluid came out through the inferior dental canal, the reaction with potassium ferrocyanide being employed to demonstrate its presence. The first gland of the inferior maxillary group on the same side was dissected out, and it also showed the presence of the injected fluid. The corresponding gland on the opposite side gave a weaker reaction at the end of forty-

eight hours. This would prove that most of the dental infection is carried by the lymph channels.

From a clinical standpoint, a sufficient number of cases have been reported to lend support to the belief that the method of transmission is variable. Gutman reported the cure of a fistula in the lower lid as the result of the removal of the upper central and lateral incisors of the same side. The explanation of the cure is the probability of the presence of bony channels extending from the alveolar processes of the upper jaw to the lower margin of the orbit. Hirsch reported a case in which complete blindness followed the extraction of the second upper left bicuspid. There was a purulent alveolar periostitis of the anterior surface of the superior maxilla which extended over the lower margin into the orbit, giving rise to inflammation of the connective tissue, optic neuritis and finally atrophy.

Of the organisms responsible for dental infection, streptococci are by far the most frequently found in the cultures from the roots of the teeth. The nonhemolytic variety is present in the great majority of cases, the hemolytic type rarely being encountered. Other bacteria which occasionally act as causative factors are pneumococci, staphylococci and *Micrococcus catarrhalis*. In Rosenow's experimental work, the micro-organism that manifested the greatest elective localizing power and with which the common forms of disease of the eye have been reproduced is a streptococcus which usually produces greenish or slightly hemolytic coloring on blood agar and which requires a reduced oxygen tension for its isolation. Haden undertook an extensive bacteriologic study of chronic periapical dental infection, and his conclusions based on cultures from the apex and periapical tissues of 1,500 teeth have been reported. The teeth were extracted under the most sterile conditions possible, and the granulomas were cut off with sterile scissors and dropped directly into a tube containing about 1 cc. of sterile 0.85 per cent sodium chloride solution and a small amount of sharp sand. Dextrose, brain agar and broth were used as culture mediums. Of 1,091 cultures, 963 showed a pure growth of streptococci and 37 streptococci mixed with gram-positive bacilli. In more than 92 per cent of the cultures, streptococci were found, either alone or mixed with other bacteria. Three hundred and forty-six of the cultures were transferred to blood agar plates, and only three times were hemolytic streptococci found—twice in pure culture and once associated with *Staphylococcus aureus*. The most common types of streptococci, as determined by the carbohydrate fermentation test, are the *faecalis, mitis* and *salivarius*.

Okumura and Nakai, in studying dental decay with particular reference to the specific parts played by certain bacteria, have found that acid-producing organisms decalcify the hard dental tissues and prepare the teeth for subsequent invasion by various germs, and that the latter

in turn are responsible for the caries. These are most commonly *Streptococcus brevis, Staphylococcus albus* and a gram-positive bacillus called *Bacillus necrodentalis.*

Bulleid found the most common cause of dental infection to be the nonhemolytic or *viridans* type of streptococcus, followed in the order of frequency by *Staphylococcus albus* more often, *S. aureus* more rarely and, finally, gram-positive bacilli.

Back, in studying the material from Elschnig's clinic at Prague, already referred to, examined 56 cases of granulomas bacteriologically. The technic of preparation and extraction differed but little from that of Haden. The contents of the sac were cultivated; blood serum bouillon and the anaerobic method of Kitt and Tarozzi were employed. Forty-seven cases showed pure culture of streptococcus; 9 a mixture of streptococcus and staphylococcus; 12 cases examined for *Streptococcus hemolyticus* showed the presence of this bacillus 4 times; a bacillus of the *viridans* group was found in the remaining 8.

Regarding the pathogenicity of cultures from dental foci, rabbits were given injections with the original broth cultures from the root tip. All types of lesions that can be produced by the intravenous dissemination of bacteria have been seen. The most common observation is a joint lesion followed, in the order of frequency, by lesions of the kidney, endocardium, myocardium, brain, eye, stomach and duodenum.

In the study of the relationship between dental infection and diseases of the eye, the roentgenogram has been used as a valuable aid, and it is of interest to note the results of this method of investigation. Bulleid concluded that in teeth the roots of which have been filled, those most likely to show rarefied areas are the ones with what might be termed good root filling, i.e., filling right to, or nearly to, the apex. Those teeth most likely to show no apical shadows in roentgenograms are the ones with no root fillings or only partially filled roots. The only extracted teeth that showed granulomas were those with no root fillings or only partially filled root canals.

Haden made a study of cultures obtained from the periapical tissue of 1,307 vital and pulpless teeth and compared them with roentgen observations. The technic employed provided: (1) proper controls to determine the chances of error, (2) a medium which is exceedingly favorable for the growth of the organisms usually encountered and (3) a means of measuring the extent of infection by determining the number of bacteria in the tissue culture.

Of 392 vital teeth, 9 per cent showed from 1 to 10 colonies in a dip agar tube; 5 per cent, 10 or more colonies and only 1 per cent more than 100 colonies. Of 490 pulpless teeth, with negative roentgenograms, 10 per cent showed from 1 to 10 colonies, 60 per cent had 10 or more colonies and 44 per cent had more than 100 colonies.

As a result he concluded that the incidence of infection is almost as high in the group with negative roentgen observations as in those with positive results. There is a sharp limitation to the translation of roentgenologic evidence of infection into terms of bacteria. The absence of roentgenologic evidence of infection at the apex of a pulpless tooth never excludes the presence of active infection. In many cases the roentgenologically negative tooth is a far greater source of systemic infection than the roentgenologically positive one, since in the former there may be little resistance to the infection.

There is a wide diversity of opinion regarding the use of vaccines and their value from the clinical standpoint. Lanier, in reporting on a series of patients with infective diseases of the eye who were treated during 1920-1921, found that he obtained more favorable results from the injection of stock vaccines or serums, both the specific and paraspecific products having been employed. Weaver expressed the opinion that streptococcus vaccines should always be autogenous, and that in general autogenous bacterins are to be preferred to the stock preparations. The best results have been obtained when the pus has been recultivated and fresh bacterin prepared every two to four weeks. In cases of iridocyclitis, cultures may be made from the aqueous, and the vaccines prepared from these have given excellent results.

Rosenow has obtained favorable results from the use of vaccines prepared from the cultured strain, but warns against expecting too much from the use of specific vaccines or serums since the diseases that are commonly the result of focal infections are usually due to streptococci, immunity to which is of short duration. In a small series of cases in which vaccines were employed, he reported 26 per cent improved, 46 per cent unchanged and 28 per cent worse, compared with 21 per cent improved, 32 per cent unchanged and 47 per cent worse, in cases in which no vaccines were used. Berens was of the opinion that patients who were treated with vaccines made from organisms to which they were particularly hypersensitive were more benefited than those treated with autogenous mixed vaccines, but 19 patients were treated with stock mixed catarrhal vaccines for control and the results compared with 19 treated with selected autogenous vaccines. The results were identical, and he concluded that the nonspecific factor is extremely important. Benedict and de Schweinitz both reported gratifying results from the use of autogenous vaccine.

In a study of the blood in cases of dental infection, Toren found a cell which he called a specific type of lymphocyte, demonstrable by a special type of stainability. It is described as a large lymphocyte, the outline of which is usually irregular, the cytoplasm of which is not the robin's egg blue of the normal large lymphocyte, but which has instead a peculiar grayish grainy appearance. The nucleus is always irregular

in contour and stains with a moderate degree of density. It is frequently cuboid or ovoid with one flattened side. The irregularity in the shape of the nucleus does not correspond with the irregularity in the shape of the cytoplasm, in other words, it is not due to pressure from adjacent cells. These lymphocytes have never been found in the blood of a patient who did not have oral infection, nor has a case of oral infection been seen in which these lymphocytes were absent. There is much doubt about this cell being a lymphocyte, since it has more the characteristics of the monocyte described by Florence Sabin of Johns Hopkins. Walter found these cells in 98 per cent of cases examined. Up to 1.5 per cent these cells are normal; above that, they are pathologic. Other observations in these cases were low normal or low white blood cell count—relative leukopenia—low red blood cell count; relatively low polymorphonuclear count; relatively high lymphocyte count; low thyroid activity; low pulse rate; subnormal temperature and low blood calcium count.

There is no definite clinical ophthalmic picture the result of dental infection. Focal infections, of which those due to the teeth form the largest group, must be considered as etiologic factors ranking in importance next to syphilis and tuberculosis. When a suspected focus has been removed and a rapid and marked lessening of the inflammation does not set in within forty-eight hours, the true cause has not been reached, and a further search should be made. Finally, while as a general rule conservatism should be practiced regarding the extraction of teeth, it should be borne in mind that in doubtful cases, the eye should be given first consideration, and elimination of oral sepsis should take precedence over preservation of the teeth.

INFECTIONS OF THE MOUTH AND THEIR RELATION TO DISEASES OF THE EYE

FROM THE POINT OF VIEW OF A GENERAL PRACTITIONER OF DENTISTRY *

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The present trend of dental thought and research is strongly toward prevention of oral disease, and for that part of the juvenile public which cooperates, much of the familiar, corrective labors of the dentist are becoming less necessary. Further discoveries in prevention seem imminent, and the increased interest of the medical profession in the one organ concerned in nutrition, the functional activity of which is largely controllable by the patient, will be a potent influence in furthering public health.

There is plenty of evidence in case histories of the direct etiologic relation of foci of the mouth to inflammatory disturbances of the eye.

In this effort to establish a better contact between the medical and the dental divisions of health service, one is confronted with the fact that those in each division are usually poorly informed concerning the anatomy, pathology and the functions of the organs in the care of the other.

This is especially unfortunate as regards the mouth, because: (1) it is the portal by which normal nutrition reaches the organism, and nutrition is fundamental to all health; (2) the normal or abnormal development of teeth and jaws influences in large measure the size of the external air passages and determines whether the tongue shall occupy its normal position or be forced back into the pharynx with resultant interference with the respiratory function, which is another fundamental of health; (3) it is the portal of entrance for a heavy percentage of the factors of infection reaching the organism from the outside, and in it are many separate potential locations for the development of foci of infection together with all the conditions favoring the proliferation of bacteria; (4) the relation of the mouth to the rest of the digestive tract insures distribution through the tract of infectious material from the former; (5) the mouth is in such a relation to the respiratory tract that it easily transfers infection from it to the bronchi and lungs under con-

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ditions that occur fairly frequently; (6) the relation of the lymphatic drainage and the blood supply of the teeth and gingivae favors easy distribution of organisms and toxins from regional foci to the lymphatic system and the blood stream; (7) effective functional use of the teeth in the initial step of digestion compels forcible introduction of filth and organisms from foci about the teeth into the adjacent vascular tissues and into their lymph capillaries.

The fact that the macroscopic anatomy, the functioning and the special pathology of the dental apparatus are so largely a closed book to other specialists because school curriculums have rarely or never included more than perfunctory mention of them, has led me to present a slide with a brief study of the anatomy of the mouth and tooth.

I wish to mention the following seven features: enamel, dentin, cementum, pericementum, alveolar bone, pulp, gingival crevice and the relations of the margins of the gingivae.

Four of these—pulp, pericementum, gingivae and cementum—are intimately related to the foci of the mouth, and a fifth—dentin—is often contributory.

The tooth pulp is often erroneously called the nerve even by dentists. It would be equally correct to call the whole eye a nerve. It contains connective tissue, specialized cells, nerves, blood and lymph capillaries. There is no collateral circulation, but the pulp in each root of multirooted teeth and a part of the bulbous portion closely associated with it, appear to have a vascular and probably a lymphatic system independent of that in the others. In its first stage, it was the formative organ for the dentin, enclosing itself except for foramina at or near the apex of the root, and it remains as its nutrient organ. When it is dead or moribund beyond capacity to function, the tooth should be called a pulpless tooth; it should never be called a dead tooth unless the pericementum is also dead. Its nerves register acute pain when irritated, but they are not concerned in the modified tactile sense of teeth. When a pulp dies, it usually decomposes like any bit of necrosed vascular tissue. The spreading of the toxins and bacteria involved in this decomposition causes many of the apical foci. Infected, but still vital pulps, the circulation and nerve function of which continue to be active, are potential foci for metastatic disease, and a greater menace than apical foci because they are usually more difficult to diagnose accurately. They frequently occur from penetration of streptococci to closed pulp chambers through normal appearing dentin without pain association or discoverable physical changes.

Thoma [1] said: "Infected pulps may remain vital for a long time, and meanwhile be a focus from which continuous absorption of bacteria and

1. Thoma, K. H.: Infected Vital Dental Pulp: An Important Focus of Systemic Disease, J. Dent. Research **8**:529 (Aug.) 1928.

their toxins may take place." His tabulation of cases supported his conclusions.

Hopewell-Smith [2] stated: "The tubes of dentin are admirably adopted for rapid and complete infection; those of the coronal region especially. The tubular nature of dentin, and the character of the contents of the millions of channels pervading it, present favorable conditions for pulp infection. This is a matter of common knowledge: but the well authenticated fact, proved by sections and photomicrographs, that infection of the pulp commonly occurs before as well as during actual exposure in deep seated cavities is not so well known."

Cementum is a thin layer of bonelike character covering the root. It is incapable of self-repair, and when infected, is difficult to sterilize.

The pericementum is an extension of the periostum, is richly supplied with nerves, blood and lymph capillaries and is the developmental, the nutrient and the reparative organ for the cementum. Its diagonally placed, interlocking bundles of ligamentous fibers attach the tooth to the lamina dura of the tooth sockets, and provide an elastic support for absorbing the shocks of functional use of the teeth. Through its nerves, we are conscious of the contact of teeth with each other and with other substances. Its blood and lymph capillaries connect freely with those of the pulp, the gingival crevice and the surrounding alveolar bone. Under physiologic conditions, it repairs damaged cementum in periodontoclasia pockets and establishes physiologic union with it, and it may seal in a dead pulp by closing the apical foramen with new cementum. Coolidge [3] recently reported a case of complete coverage of the dentin of a resected root end with new cementum.

When pulp infection or necrosis causes infiltration of periapical tissues, thickening of the cementum is usually the first physical change discoverable roentgenographically.

A periapical focus may exist without enough physical change in the pericementum to register in a roentgenogram. Periodontal abscess may occur without pulp infection, probably from infection of lymph capillaries from the gingival crevice, and they are potential foci.

The free margin of the gingivae surrounds the teeth like a collar, forming a crevice one sixteenth of an inch deep, or less. The epithelial covering of the outer gingival surface is thick and tough; that of the inner surface is thin, and lymph capillaries apparently open into it. They also connect with the pericemental vessels.

Other potential foci are abscesses in the gingivae. They are easily located and usually yield promptly to indicated treatment.

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2. Hopewell-Smith: Adventitious Dentins and Infection of the Dental Pulp, Dental Items of Interest, July, 1925, p. 477.

3. Coolidge, E. D.: Root Resection as a Cure for Chronic Periapical Infection, J. Am. Dent. A. **17**:239 (Feb.) 1930

Foci are often established in the tooth pulp as a result of infection connected with caries, and the resulting pulp abscess, or other lesion, may develop on the surface or within its substance. Ordinarily, this leads to death of the pulp, but Thoma,[4] has demonstrated that resolution can occur in pulp abscesses, and the pulp continue to function for a considerable period thereafter in teeth the pulp chambers of which have not been penetrated by caries. Exact information as to the complete pathologic picture from first slight infection to establishment of a definite pulp focus and then pulp death, is difficult to obtain, because the pulp tissues are so effectively covered from observation as to mask the conditions completely until they reach an advanced stage.

PROGRESS OF PULP INFECTION

Clinical observation and interpretation indicate that the progress from mere abnormality and stimulation of protective activity to deposit adventitious dentin, because of beginning invasion by toxins and bacteria on through hyperemia, congestion, inflammation and stases to a moribund condition, may be spread over many weeks or even months. The pathogenic organisms of these pulp abscesses and their products are in close relation to the engorged capillary and lymph vessels. Cases reported by Thoma [1] and Rickert [5] indicate that the infected vital pulp is a rather frequent focus in lesions of the eye.

Only one of the eight cases reported in Thoma's article related to the eye, but the list is instructive. It includes one case each of symptoms of general toxemia and lameness of the joint; chronic exhaustion and rise in temperature; multiple arthritis; swollen, painful extremities; retrobulbar neuritis; high blood pressure; pain and swelling in the right wrist, and neuralgic pain.

In all these cases, the primary focus was within the pulp chamber, where its presence would be recognized only by an expert interpreter of exceptionally good roentgenograms of individual teeth, coupled with intelligent correlation of the strictly dental physical conditions and history. All of the patients either recovered promptly or showed marked improvement on removal of the foci of the mouth.

It should be borne in mind that most dentists can supply case histories in which removal of suspected teeth has brought no improvement in the conditions for which they were held responsible, and in which their loss caused a major disability for the patient.

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4. Thoma: A Comparison of Clinical, Roentgen and Microscopical Findings in Fifteen Cases of Infected Vital Pulps, J. Dent. Research **9**:447 (Aug.) 1929.

5. Rickert: The Clinical Significance of the Infected Degenerating Pulp, J. Am. Dent. A. **14**:1895 (Oct.) 1927.

One of the saddest experiences of my professional life was my aquiescence in the removal of several teeth for a woman, without the slightest discoverable benefit. No tooth was removed without proof of the presence of pathogenic organisms in its periapical tissues. I now believe that the internist was groping in the dark in a last stand against conditions in which removal of foci was futile, and that the patient's last three years were made desperately unhappy because of inadequate diagnosis and honest but mistaken professional zeal.

Reflex pain on any branch of the fifth nerve is not uncommon when the effort of an inflamed pulp to swell within its chamber or when adventitious dentin nodules cause irritation of pulpal nerves.

A common history of progress of pulp infection is: (*a*) slow infiltration through the rest of the pulp tissue to the pericementum of the apical area, while the pulp is still alive; this is usually associated with a streptococcic infection; or (*b*) death of the whole pulp before the disease extends beyond the apex of the root. These cases I believe to be usually associated with staphylococcic, or mixed infections, which set up an inflammatory reaction resulting in strangulation of circulation at the foramina.

In either case, an additional focus is often established in the periapical tissues. If staphylococci are among the invading organisms, active inflammation and suppuration usually occur there, pus burrows through the tissue, the face swells and pus finally evacuates with or without interference. The fistula from such an abscess ordinarily remains open, and steadily discharges small quantities of pus into the mouth, or the mucous membrane may, from time to time, close over the opening, in which case the chronic "gum boil" and periodic discharge will occur.

Often the organism involved is *Streptococcus viridans*, and then the local irritation is slight. After pulp death as a result of infection, infiltration of the tissues commonly results in (*a*) the development of a small cavity in the alveolar bone, around the root end, within which the involved tissues are often encapsulated; a condensing osteitis may result in the development of a narrow zone of dense bone around them, which shows up as a white line on the roentgenogram; or, (*b*) the organisms may spread into the alveolar bone and set up changes registering in the x-ray picture as a dark area of irregular form.

Other than occasional slight tenderness, these conditions may persist for years without enough local disturbance to attract attention. The secondary local condition, which carries the lesion definitely beyond the range of conservative treatment, is the stripping of the peridental membrane from the cementum and the infection of the latter. Infected cementum in this region cannot be sterilized, and it cannot be exfoliated until the whole tooth goes with it. In teeth with single roots, resection

of the root end may properly be considered, but in multirooted teeth, extraction is the correct operative procedure when a root tip has become denuded.

Poor technic in extraction may leave the infected tips of roots or other infected tissue in the wound, where they may continue to act as foci.

Most of the pulp infections are due to caries, and much of the caries causing them has its beginning in fissures, which are developmental defects.

Here is the real battleground for prevention of pulpal and apical foci.

The child for whom each tooth receives protective treatment within six weeks of its eruption, and who is effectively taught adequate mouth hygiene, should have little if any trouble through life, from pulpal, apical or periodontoclasia foci.

There are indications that prevention of developmental fissures, and when they are present, prevention of caries in them by nutritional practice, may soon prove to be possible. If, or when, this happens, dentists will lay the responsibility for occurrence of pulpal and apical foci on the shoulders of the parent, and will be most emphatic in their insistence on the great importance of preventing the incidence of disease apparently so prolific a cause of secondary disease.

Toxic and bacterial penetration of the dental tubuli may be rapid, and in the deciduous teeth of children, the distance between the floor of the cavity and the pulp chamber is short. In all cases of disease of the eye that may be of focal origin, and especially in children, there should be careful search for infected vital pulps. This involves search for possible hidden caries as well as close scrutiny of all fillings. When extraction of suspected pulpless teeth results in no benefit for a secondary infection probably due to foci of the mouth, it should prompt intensive search for infected vital pulps.

When organisms in the pulp chamber set up inflammatory action or cause gas formation, they are forced out from the infected pulp chamber into the periapical tissues. After spontaneous death of pulp, there is usually seepage through the foramina into the periapical tissues. and in the absence of corrective treatment, the decomposing remains of the pulp and of the fibrils in the dentin are a continuing reservoir of chronic infection. The dental point of view of the past has been that the complete removal of the remains of the pulp, the sterilization of the pulp chamber, such incomplete sterilization of the dental tubuli as may be possible and complete closure of the chamber with inert material, make it safe to retain such teeth in the mouth.

To do this effectively taxes the utmost skill of the dentist. Much incomplete and slipshod work has been done in this field and it is largely responsible for the heated arguments as to whether any pulpless tooth may be safely retained.

EXTRACTION OF PULPLESS TEETH

Conservative dental opinion does not yet sanction extraction when pulp infection or death has been discovered, and adequate treatment carried out before tissues outside the tooth have become pathologic beyond their capacity to recover. If patients with uveitis and iritis recover promptly after removal from the tooth pulp of a focus etiologic to them, it is rational to expect patients with well advanced pericementitis to do the same.

The reluctance of the dentist to extract suspected pulpless teeth is frequently misunderstood and criticized. When the case history includes grave secondary disease probably, or possibly, due to infection, and no other focus can be located, then any or all teeth possibly involved must be sacrificed unless their condition is such that probable foci can be quickly removed by less extreme measures.

Many millions of pulpless teeth are functioning effectively today in mouths of persons in perfect health, as indicated by competent physical examination. This tends to support the conservative view that because of apprehension about disease that is believed to occur in only a small proportion of those in which it is potential, radical action which will set up a permanent and often grave disability in an important organ is ill advised for a person in sound health. The extraction of a single tooth from an already mutilated denture may change its status from one capable of being maintained in efficient function to one so inefficient that entire artificial dentures will become essential. The extraction of a single tooth from a sound denture, and neglect to fill promptly its place with a substitute, may result in the gradual establishment of serious functional inefficiency of the whole masticating organ.

The mouths of clinic and hospital patients are frequently foul, and the gingival crevice and the pus pockets that occur as extensions of it in these cases are always seething with infection. Their close relation to the lymphatic drainage leads me to mention this condition as worthy of consideration when one is seeking the location of a primary infection. In that connection I want to record here the opinion that any surgeon who permits the administration of a general anesthetic through a filthy mouth accepts a grave risk of serious complications of the respiratory tract sometimes culminating in abscesses of the lung, and of being compelled to write into his case history: "Operation successful—patient died."

Periodontoclasia has not yet received sufficient emphasis as a probable focus of infection. Noyes and Dewey [6] quoted Ollendorf as having reported enlarged glands in all but 3 of 2,246 patients with periodontitis, evidently using the term as equivalent to periodontoclasia in the present terminology. Haden,[7] in his excellent book regarding association of chronic oral infection and chronic disease, reported a series of 47 ophthalmic cases associated with foci of the mouth, in which he found three fourths of the foci to be periapical and one fourth gingival, and another from Irons [8] in which 36 per cent of 47 patients with iritis had periapical infections.

Hartzell,[9] a physician and dental specialist in periodontoclasia, stated that a case of advanced periodontoclasia may present the equivalent of approximately 7 square inches of ulcerating surface from which the lymphatics, veins and blood stream can be and are invaded. He regards periodontoclasia, which, under present hospital routine, may frequently exist without knowledge of either physician or dentist, as a frequent cause of leukopenia and secondary anemia. When periodontoclasia reaches an advanced stage, there is more than opportunity for the spread of infection from its pus pockets; there is a driving force, due to ordinary functional use of the teeth, constantly compelling migration into the surrounding vascular tissues.

In a recent paper under the title "Focal Infection from the Ophthalmologist's Standpoint," G. Orum Ring,[10] reported a case of interest. After saying that periapical infection is probably the most frequent cause of secondary manifestation of local infection, Dr. Ring stated his position as follows: "No operative case in ophthalmology which involves the opening of the eyeball should ever be undertaken without a complete dental study. An exception to this dictum that I would permit would be such a case as one of acute inflammatory glaucoma or one associating ocular with serious sinus disease."

The high points of the case referred to are as follows: The patient, aged 65, had acute uveitis; vision was 20/200 and was hazy. The white cell count was 13,000, and there were six infected teeth. He concluded:

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6. Noyes, F. B., and Dewey, K. W.: Lymphatics of the Dental Region, J. A. M. A. **71**:1179 (Oct. 12) 1918.

7. Haden: Dental Infections and Systemic Disease, Philadelphia, Lea & Febiger, 1930, p. 33.

8. Irons, E. E.: Dental Infections and Systemic Disease, J. A. M. A. **67**: 851 (Sept. 16) 1916.

9. Hartzell, T. B.: Interesting Cases of Advanced Periodontoclasia Before and After Treatment, J. Am. Dent. A. **16**:1307 (July) 1929.

10. Ring, G. O.: Focal Infection from the Ophthalmologist's Standpoint, Dental Cosmos **72**:280 (March) 1930.

The case strikingly illustrated also the exacerbation of the symptomatology following the sudden pouring into the blood stream of an additional group of viridans streptococci upon the extraction of the first two of six teeth. The same experience was repeated a week later when the third and fourth teeth were extracted. By this period, the autogenous vaccine was being administered and when still a week later, the last two offenders were sacrificed, the resistance had been raised, the inflammatory symptoms rapidly subsided, and the vision returned to normal. This briefly was the dominant symptomatology in an eye headed for disaster, unless the blood stream leading had been followed to its toxic foci, upon the elimination of which a perfect result was produced.

Dr. Ring reported three other cases of uveitis, all with a similar blood picture, the presence of infected teeth and a similar result.

With full realization of the gravity of the secondary disturbance that may result from the retention of undetected foci about pulpless teeth, I am satisfied that the public welfare will not be served by advising indiscriminate removal of all pulpless teeth, which is advised by some practitioners, but in the present state of knowledge, all of them should be kept under observation. Numerous observers have recorded the presence of pathogenic bacteria in pulps and in apical areas, in which no indication of a pathologic process or lowered function could be detected. In the absence of definite evidence of the presence of a focus, I would counsel a conservative attitude on the part of all practitioners of medicine in urging the removal of teeth regarded as important by a well qualified dental consultant familiar with root therapy.

Diagnosticians and oral surgeons constantly see cases in which tooth infection has caused disturbance, but they lack the opportunity to evaluate the status of the much larger number of pulpless teeth that cause no trouble and are valuable functioning units in their respective dentures.

This fact leads to a considerable divergence of opinion between them and general practitioners of dentistry. There is little doubt that the general practitioner often overestimates the importance of certain teeth, but in my opinion, the tendency of the surgeon and diagnostician to class all pulpless teeth as dangerous is influenced by their limited opportunity for observation of the whole field.

Hanke's [11] demonstration that the local resistance of gingival tissue already attacked by pathogenic organisms can be built up quickly by simple nutritional therapy to a status enabling it to repel the attack without local treatment should be tested in other fields, and it seems possible that it may permit considerable revision of the present evaluation of simple foci.

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11. Hanke: The Relation of Diet to Caries and Other Dental Disorders, J. Am. Dent. A. **16**:2263 (Dec.) 1929, and a recent unpublished paper.

Robert B. Osgood,[12] speaking from the orthopedic point of view, counseled conservatism in surgical and dental removal of foci not proved to be affecting the general health of the patient unless sure they "are not simply themselves expressions of a lowered vitality for which there are other causes." Hanke appears to have shown that in the gingivae, the first stage of an important group of foci of the mouth is due to a local expression of lowered vitality caused by nutritional imbalance of a type usually easy to correct.

Up to 1911, the presence of lymphatics in the dental pulp was denied. Noyes[13] has recently shown that lymphatics draining the pulps and pericemental tissues of teeth in the maxilla join the drainage leading through the infra-orbital canal, while in the mandible they pass to the inferior dental canal, and that from both areas they reach the first submaxillary lymph node. His latest demonstration proves that fluids can be passed through the tubuli of sound teeth into the pulps. Applebaum,[14] working under Bodecker, and Fish[15] have reached the same conclusion. Bodecker, Applebaum and Fish consider the fluid content of the tubuli to be lymph, while Noyes leaves the question open.

The fact that liquefaction of the organic content of dental tubules is all that is needed to permit direct migration of organisms through them to the lymph capillaries, places the carious cavity of the tooth on the list of potential foci of infection, lends emphasis to the importance of the search for an effective means of preventing dental caries, and places on the dentist the responsibility of protecting the exposed ends of tubuli in vital dentin from possible infection during operative procedure.

Hanke, Price, Davis, Drain, Boyd, Bunting and others, each working by a different technic, seem to be approaching a tentative conclusion that nutrition, optimal in quality, and freedom of the organism from overload of surplus food and waste products, are the really important factors in the prevention of dental disease.

Is it just possible that the connection between the mouth and the field of every other specialty is the extreme popularity of that age old entertainment—the tickling of the palate with an attractive but unbalanced food ration, bringing in its train susceptibility to the attacks of the myriads of micro-organisms that are always with us?

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12. Osgood: Orthopaedic Aspects of Chronic Arthritis, J. Bone & Joint Surg. **8**:1, 1926.

13. Noyes, F. B., and Ladd, R. L.: The Lymphatics of the Dental Region, Dental Cosmos **71**:1041 (Nov.) 1929.

14. Applebaum: Lymph Channels in Dentin and Enamel Stained by Amalgam, J. Dent. Research **9**:487 (Aug.) 1929.

15. Fish, E. W.: The Circulation of Lymph in Dentin and Enamel, J. Am. Dent. A. **14**:804 (May) 1927.

If the research observations indicating that right nutrition can render gingival mucous membranes immune to bacterial attack are correct, as now appears probable, are not other mucous membranes logical fields for similar research? Tooth pulps will surely be subjected to such a study. I venture no hypothesis about eyes, but I think all will admit the soundness of the principal of building up resistance in any organ or tissue where it is possible to do so. A healthy and effectively functioning masticating organ is an essential in establishing optimal nutrition.

In this connection, it is to be noted that several investigators have stated that *Streptococcus viridans* can be cultured from vital and apparently healthy pulps of all teeth that are carious and of all those that have periodontoclasia in moderate degree.

It has been amply proved that organisms and toxins from all foci of the mouth, including the carious cavity and the gingival pus pocket, have a direct drainage path through the lymph channels to the blood stream.

The ophthalmologist will evaluate these facts and apply them to his own field of work. For the dentist they mean increasing vigilance in preventing the establishment of foci and intensified interest in intelligent cooperation with the ophthalmologist whenever a search for primary foci responsible for disease of the eye is indicated.

Rickert [5] quoted a New York dentist as having written to him on the publication of his first article, concerning degenerating vital pulps as follows: "You may be right about the seriousness of the infected degenerating pulp, but soft pedal on the subject, for if the medical profession ever gets the idea that vital teeth may, at times, be infected and a menace to general health, Heaven help us." I venture to hope that this was half humorous and the result of exasperation after an unhappy experience in consultation. Whether it was or not, the dental group in this conference is eager to have the medical profession know all the facts, because a full realization of them must lead to its active support in the campaign to teach the public that at least half the potential dental ills of the child who starts right and plays the game loyally are preventable throughout life, and to their active cooperation in, and support of, the present search for more effective means for limiting the incidence of caries and periodontoclasia.

My concluding word to this group is this: In his effort to serve the public with due regard to the best health service principles, the dentist is in great need of cooperation from the ophthalmologist in order to insure better understanding of conditions that are of mutual interest, and the public welfare will be served if the ophthalmologist weighs with deliberation and care the views of the conservative dentist concerning conditions in the mouth and his estimate of the values of radical surgery in that field.

SUMMARY

My conclusions based on reported case histories are as follows:

1. Any variety of foci in the mouth may be a cause of disease of the eye.

2. Infected vital tooth pulps, apical areas, periodontoclasia areas and impacted teeth are the four most common foci of the mouth to be considered.

3. A negative roentgen examination of a pulpless tooth is inconclusive if there is reason to suspect a focus of the tooth.

4. If a focus of the tooth is suspected, a negative roentgenogram plus negative results of a physical examination of the mouth call for keen search for infected vital pulps.

5. If streptococcal infection is suspected, absence of pain in the teeth does not eliminate foci of infection, but should spur one to a keener search for infected vital pulps.

6. The lymph and blood circulation of the tooth pulp and periodontal tissues suggest that this is the path by which infection from foci in the teeth reaches the eye. Case histories in which mandibular teeth were the source strongly tend to confirm this view.

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Clinical Notes

NEEDLE HOLDER FOR CATARACT SURGERY*

EDMUND B. SPAETH, M.D., PHILADELPHIA

Since working with Dr. Luther C. Peter, I have become firmly convinced that one of the great essentials for success in operation for cataract is that the lid and conjunctival sutures are properly placed. This subject was presented by him recently in the *American Journal of Ophthalmology.*

Of all the various needle holders available, none were quite satisfactory for the conjunctival sutures. Some released with a disturbing (to the patient) click; others were improperly shaped for passing the needle from the conjunctival flap toward the intact bulbar conjunctiva. The patient not uncommonly moves his eye during the introduction of these sutures, and disastrous results can develop when the flap is held rigid during such movements. Clamp or catch holders are thus unsatisfactory. In spite of this, nothing was quite as satisfactory as the ordinary mosquito size hemostatic forceps.

Needle holder for cataract surgery.

The needle holder illustrated was filed out and tried at the operating table until its present shape appeared. Its length is such that it rests between the tips of the thumb and first finger. The spring is adequate for rapid release of the jaws but still without undue tension necessary for closure. The curve of the head from the lock allows for angulation downward in introducing the sutures by a clockwise rotation of the holder when working from above or a counter clockwise rotation when working from below. The jaws will hold the smallest needles without allowing them to twist in the holder and without breaking them. Also, because of the ease with which it opens and closes, the holder acts as an assisting forceps with sutures that are to be tied immediately after their introduction.

However, the holder is not satisfactory in muscle surgery because of its shape. In this work a straight needle holder is necessary.

The holder is made by Pilling Company of Philadelphia, who assisted in completing the instrument.

1930 Chestnut Street, Philadelphia.

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* From the Peter Clinic Graduate School of Medicine, University of Pennsylvania.

Abstracts from Current Literature

EDITED BY DR. WILLIAM ZENTMAYER

Conjunctiva

PATHOGENESIS OF VERNAL CONJUNCTIVITIS. A. FERRARI, Arch. di ottal. **37**: 26 (Jan.) 1930.

The author reviews the literature on the cause of vernal conjunctivitis, emphasizing especially the opinion of Rossi, who believed that a deficiency of the sympathetic nervous system was present in such cases, which explained the usual onset of the disease at the time of puberty, when greatest claims are being made on this system, and symptoms of deficiency would be likely to appear. The evidence offered by the author in favor of this theory, besides the common age of onset of vernal catarrh, is chiefly its frequent occurrence in children with lymphatism and other signs of an undeveloped glandular system, and also the finding of calcium deficiency in the blood of such patients, and their improvement under calcium therapy. The author speaks of "the almost constant diminution of calcium" found by Wood, who reported two cases. He also mentions the results of pharmacodynamic tests in such cases, which show a hyposuprarenalism and the signs of hypogonadism observed by some authors. The article is a review and records no personal cases.

S. R. GIFFORD.

TWO CASES OF CONJUNCTIVITIS WITH CONJUNCTIVAL VEGETATIONS AND A HIGH DEGREE OF ADENOPATHY. CLINESCU-CALCIUNESCU, Cluj. med., 1929, no. 9.

Two patients, both aged 40, had practically the same clinical manifestations. They showed conjunctival secretion of the right eye and swelling of the parotid region. The conjunctiva of the upper tarsus and culdesac was markedly hypertrophic and covered with granulations and vegetations. Marked thickening and congestion of the conjunctiva, pericorneal chemosis and preauricular tender adenopathy were present. The temperature was from 37.5 to 38 C. (99.5 to 100.4 F.). Cytologic and bacteriologic examination gave negative results, as did the biopsy and inoculation into guinea-pigs. Histologic examination revealed diffuse infiltration of mononuclears; eosinophils 3.5 to 4.2 per cent. After three months the patient recovered completely. Treatment consisted of antiseptic solutions, silver nitrate and copper sulphate. In both cases the condition was interpreted as Parinaud's conjunctivitis.

N. BLATT.

Congenital Anomalies

HUMAN LENS WITHOUT NUCLEUS, A HITHERTO UNKNOWN MALFORMATION. F. SALZER, Klin. Monatsbl. f. Augenh. **84**: 52 (Jan.) 1930.

In a woman, aged 45, vision had been greatly reduced since childhood by corneal opacities of both eyes. An artificial coloboma downward and to the nasal side allowed her to read ordinary print with her right eye

without glasses by tilting her head backward. This eye showed red fundus reflex and a round shadow, measuring about one third of the diameter of the iris, in the center of the pupil. The upright virtual picture of the fundus was clearly visible through this area. The margin of the lens appeared in the coloboma.

The slit-lamp revealed some opacities of the anterior cortical, then an apparently empty space in lieu of the nucleus, then the posterior cortical, the posterior capsule and the structure of the vitreous. No crystals or other elements could be detected in the central cavity of the lens; no remnants of the hyaloid artery were present. The patient's vision was 5/15 with a convex glass of 11 diopters, and she could see the finest print at 30 cm. with a 14 diopter lens.

Fischer's description of vacuoles in the eyes of human embryos may be mentioned in this connection, although neither his cases nor those described by Hess and by Scily present clear vacuoles and a clear cortical shell like Salzer's case.

K. L. STOLL.

Cornea and Sclera

SUPERFICIAL PUNCTATE KERATITIS. R. E. WRIGHT, Brit. J. Ophth. **14:** 257 (June) 1930.

This is a detailed account of an epidemic form of keratitis which appeared in Madras about May, 1928, and continued during the year that followed, embodying observations relating to the clinical appearance, biomicroscopy, epidemiology, etiology and histopathology of the disease, based on the investigation of more than 900 cases.

Clinically, the disease presented resembles the superficial punctate keratitis described in the literature rather than any other well known corneal disease, but includes also such forms as those described by Herbert and by Kirkpatrick, the keratitis epithelialis punctata of Koeppe and the keratitis disciformis of Fuchs. The biomicroscopic appearances show great diversity in the lesions, although the initial and essential change, which is a localized opacification immediately on either side of Bowman's membrane, is probably common to all. Similarly, Descemet's membrane and the endothelium may show a great variety of changes, and the evidences of abnormal constituents in the aqueous fluid may vary in character from an increase in relucency to gross pigmented and unpigmented keratic precipitates.

Experimentation with animals shows that apparently the disease is transmissible to man and black rabbits by corneal implantation. *M. sinecus* does not appear to be susceptible; possibly this is also the case with white rabbits. Experiments on animals support the bacteriologic and histopathologic observations and the clinical features of the disease, and point to a specific filter-passing virus as the etiologic agent.

W. ZENTMAYER.

ASPERGILLOSIS OF THE CORNEA. N. DI FEDE, Arch. di ottal. **37:**41 (Jan.) 1930.

A man, aged 40, had noted inflammation of one eye for ten days, some dust having blown into the eye while he was at work in the field. A few days later, he noticed a ring of opacity in the cornea. He

showed a corneal ulcer with borders infiltrated equally in all directions and a rough, raised area near the center. Most of the opaque area was removed with a needle and the material used for smears and cultures. Smears showed the branched threads and fruiting bodies of a mold which proved on culture to be *Aspergillus fumigatus*. A drop of the culture on the scarified cornea of the rabbit or guinea-pig produced a characteristic ring-shaped infiltration. This is the only case ever seen by the author, who considers that the peculiar roughness and equal infiltration around the margins of the infiltration present a distinct picture suggesting the diagnosis of keratomycosis.

S. R. GIFFORD.

General

THE PSYCHOPHYSIOLOGIC FITNESS OF AUTOMOBILE DRIVERS. L. WEEKERS, Arch. d'opht. **46**:717 (Dec.) 1929.

This question was a subject of discussion at the Amsterdam International Congress of Ophthalmology. The author admits the great difficulty with which the solution of this problem is surrounded. He presents evidence to show the relationship between the fitness of automobile operators and the number of accidents. The number of accidents can be diminished by the elimination of the unfit, and the more rigorous the selection the greater will be the reduction. He believes that the psychologic factors are the most important. A complete psychologic investigation of every operator is impracticable from a purely technical point of view. He suggests (1) that a minimum physical fitness be required, and (2) that those operators who are unfit from a psychologic standpoint be eliminated at the time of an accident. From the medicolegal standpoint he thinks that the responsibility should not be proportional to the fault. The responsibility should be entire, however slight the error, negligence or imprudence. He presents a scheme of regulation, and discusses each rule at some length.

S. B. MARLOW.

PHENOBARBITAL IN OPERATIONS ON THE EYES IN CHILDREN. H. MEYER, Klin. Monatsbl. f. Augenh. **84**:69 (Jan.) 1930.

The author describes the satisfactory results of the use of phenobarbital in Axenfeld's hospital. Internal doses of from 0.1 to 0.15 Gm. are given twice daily for the after-treatment of nervous adult patients. It has been used in children during the last year in the following doses: 0.02 Gm. for children aged 4 months, 0.05 Gm. for those aged 1 year, 0.06 Gm. for those aged 2 years, 0.09 Gm. for those aged 5 years, 0.1 Gm. for those aged 6 years and 0.15 Gm. for those aged 12 years. Phenobarbital is administered while the patients are still in bed, an hour prior to the operation. The children offer no resistance when so put on the operating table, with the result that exact examinations can be made, or they can be placed properly for irradiation; local anesthesia and other preparations are facilitated in extirpation of the tear sac, in enucleation, in tenotomy and in smaller plastic operations on the lids or the conjunctiva. The administration of phenobarbital preceding a short ethyl chloride narcosis is sufficient for tonometry in hydrophthalmos, discission of congenital cataracts and iridectomy; it reduces the quantity

of ether required for trephining in buphthalmos, complicated iridectomies, linear extraction, magnet extraction and more complicated plastic operations; it also lessens the frequency of vomiting after operations.

K. L. STOLL.

General Diseases

TWO CASES OF CRANIOFACIAL DYSOSTOSIS OF CROUZON. P. PESME, Arch. d'opht. **46:**738 (Dec.) 1929.

Although tower skull has been known since the work of Von Michel and Virchow, in 1912, Crouzon first described another type of malformation associated with optic atrophy. This condition is characterized by: (1) a cranial deformity somewhat resembling oxycephaly, (2) facial malformation, especially in regard to the nose and jaw with a resulting prognathism and (3) ocular disturbances consisting of exophthalmos, divergent strabismus and loss of vision. Crouzon thought that a fourth characteristic was the hereditary and familial nature of the condition.

The author describes two cases, with excellent photographs and roentgenograms. In neither case was there evidence pointing to hereditary or familial traits. The pathology of this condition is complex. It is thought that premature closure of the bones of the skull best explains the condition. In oxycephaly it explains the intracranial hypertension. The involvement of the bones of the base account for the ocular manifestations. An atresia of the orbit results so that the eye itself rests in the orbit like an egg in an egg-cup. Compression of the nerve in its bony canal produces the atrophy. No definite etiology has been established. At the present time it is thought by Crouzon and Chatelain to be a hereditary dystrophy. The condition is of interest to ophthalmologists because of the involvement of the optic nerve and the eye.

S. B. MARLOW.

Glaucoma

GLAUCOMA AND GLAUCOSAN DROPS. C. HAMBURGER, Brit. J. Ophth. **14:** 172 (April) 1930.

The author points out the variety of operative procedures that have been devised for the cure of chronic glaucoma, and believes that this proves their unreliability. To prove the fallacy that a good technic guarantees success, he cites a few examples of unsuccessful operations by famous oculists. His treatment for glaucoma simplex consists of: (1) miotics; in case they suffice he gives nothing else; (2) drops of the epinephrine substitute glaucosan if the tension remains high, and (3) operation, as a rule only if these conservative measures fail.

A disadvantage of treatment with the epinephrine substitute glaucosan is the rise of tension that occasionally ensues. As a rule, this is temporary and the resulting tension is usually so much the lower. The best way of combating the rise is by the instillation of 0.5 per cent physostigmine and the injection of 10 cc. of 10 per cent salt solution in the vein of the arm, and, if need be, by the subcutaneous injection of morphine. He commends Gifford's method of using physostigmine both before and after the epinephrine substitute glaucosan. The author

treats only one eye on one day. He admits that the action of this drug is temporary, lasting for only days or weeks. The administration has only to be repeated.

The drug is especially valuable in secondary glaucoma following iritis. He states that he does not aspire to render glaucoma operations superfluous by means of the epinephrine substitute glaucosan.

W. ZENTMAYER.

CLINICAL AND EXPERIMENTAL STUDIES ON THE LOCAL AND GENERAL VASCULAR DISEASE IN GLAUCOMA SIMPLEX. K. SCHMIDT, Arch. f. Augenh. **100-101:** 190, 1929.

After a considerable theoretical discussion of the relation of intra-ocular pressure to the degree of filling of the choroidal reservoir, the author reports a series of cases of glaucoma simplex in which the state of the capillaries was tested by drinking distilled water. Following the ingestion of large quantities of distilled water, the hemoglobin, intra-ocular pressure, specific gravity and amount of urine were measured according to the technic of Marx.

Of thirty-four patients having glaucoma simplex, thirty-three showed abnormal results of the experiment, idicating a general disturbance of the capillary system throughout the body. Patients of similar age in good health showed a typical result. A rise of pressure which occurred during the course of the experiment in the glaucomatous eye indicated a further local disease of the capillaries on that side.

F. H. ADLER.

THE PERMANENT RESULTS OF CYCLODIALYSIS. RICHARD STEIN, Arch. f. Augenh. **102:** 626, 1930.

On the basis of ninety-six cases from the private practice of Professor Elschnig, the following conclusions were drawn as to the permanent results of cyclodialysis.

Compared to the results of corneoscleral trephining, the author regards the effect of cyclodialysis as of equal value in controlling the rise of intra-ocular pressure in compensated and chronic uncompensated glaucoma. If one compares the complications of this operation with those of corneoscleral trephining, it is apparent that it is much safer.

Further, this operation is of more value than the trephine operation in maintaining the function of the eye, particularly the visual fields.

F. H. ADLER.

LENS CAPSULE GLAUCOMA (GLAUCOMA CAPSULARE). A. VOGT, Klin. Monatsbl. f. Augenh. **84:** 1 (Jan.) 1930.

This condition was described for the first time by the author in 1925. A pale blue edge of varying thickness may be seen at the pigment seam of the iris of persons, aged from 60 to 80; rarely at an earlier age. This edge is a conglomeration consisting of fine detritus worn off by the motion of the pupil and of a subtle membrane covering the anterior capsule. These small elements of detritus settle on the pupillary margin, and once in the aqueous humor inhibit the lymph circulation. Sev-

eral membranes of this description have been found, one above the other. This phenomenon was observed in forty-five patients, thirty-four of whom had glaucoma. The histologic conditions in one of these cases have been described previously by Rehsteiner *(Klin. Monatsbl. f. Augenh.* **82:** 21 [Jan.] 1929) who appended slit-lamp pictures and photomicrographs.

These cases, considered heretofore to be primary glaucoma, are of the secondary type and offer a prognosis less favorable than common glaucoma. The author deems it significant that the lens capsule, thought to be irrelevant as a pathologic factor, may directly produce glaucoma.

K. L. STOLL.

ABSOLUTE GLAUCOMA RENDERED PERMANENTLY PAINLESS AND CILIARY NEURALGIA CURED BY ANESTHETIZING THE GASSERIAN GANGLION. W. ALEXANDER, Klin. Monatsbl. f. Augenh. **84:**65 (Jan.) 1930.

This is the author's second article on anesthesia of the gasserian ganglion by the injection of alcohol; the first publication is to be found in *Medizinische Klinik* (23: 1103, 1927). He rejects the resection of the ciliary ganglion and Grueter's injection of alcohol into the orbit on account of their risk and adverse complications. Injections of alcohol into the gasserian ganglion gave great satisfaction in neuralgia of the trigeminus, as they were not followed by ill effects.

The case of a man who developed secondary glaucoma after thrombosis of the central retinal vein is reported. Severe pain in the eye and in the entire side of the face, besides vomiting, disappeared completely and permanently after an injection of alcohol was made into the gasserian ganglion in June, 1927; no disfiguring changes occurred. The patient's blood pressure is still 210 mm.; the tension of his eye is unchanged.

Neither normal nor pathologic tension of the eyes is influenced by this method. In recommending it in all cases of ciliary neuralgia with perfectly normal eyes, the author refers to one of his cases (published in 1927) in which the first injection produced painlessness for one year, the second for five years, up to the time of this writing. The vision remained perfect; disturbances or disfiguring complications did not appear.

K. L. STOLL.

THE ACTION OF GYNERGEN ON OCULAR TENSION IN GLAUCOMA. GLAVAN, Cluj. med., 1929, no. 9.

After the injection of gynergen the arterial tension, pulse, respiration and eye pressure were investigated. Gynergen leads to bradycardia, leaves the arterial tension unchanged and hastens respiration. Eight patients with glaucoma were daily given from 3 to 5 mg. of gynergen by mouth or 1.5 mg. hypodermically. In simple glaucoma, ocular pressure is lowered and even becomes subnormal; in chronic inflammatory glaucoma it causes also hypotonia, even also in absolute glaucoma. The author feels entitled to value the effect of gynergen higher than that of mydriatics. He recommends the use of gynergen as preparation for antiglaucomatous operations. The action of gynergen on eyes with normal tension is very slight.

N. BLATT.

Hygiene, Sociology, Education and History

A Brief Historical Sketch of Native Ophthalmology in China. H. T. Pi, Nat. M. J. China **15:** 604 (Oct.) 1929.

Ophthalmology in China had its beginning more than four thousand years ago, in the prehistoric times of the three legendary rulers. Huang Ti is the last of the three, and it was in his reign, dating from 2679 B. C., that the most important of all treatments for diseases of the eye, the needling method, was originated. Books on medicine in general, including diseases of the eye and their treatment, were also written for the first time. It is well established that the actual time of the beginning of Chinese ophthalmology was somewhere near the time of Confucius or shortly after. "The Importance of Needling," a product of the Han Dynasty, 250 B. C., may be considered the first of the reliable sources on ophthalmology. Next came the famous Wang Wei Teh of the Sung Dynasty, who took special pains in gathering information on needling and finally succeeded in producing his well known original brass model of the human body for that purpose. A more comprehensive work on needling was produced by Chin Hsien. This has become the first book of reference on this subject for the native oculists today. The book is well written, deals with almost all aspects of ophthalmology and is richly illustrated with pictures and drawings. The first book devoted exclusively to diseases of the eye appeared at a much later time, 620 A. D. Eighty-one kinds of diseases of the eye are carefully described, numerous prescriptions are given and the method of needling, cauterization for entropion and needling of cataracts are fully described. Necessary prayers are also discussed.

Pi cites the following case from this book: "Windy Granules of Palpebral Conjunctiva," trachoma (?), is caused by the increase of blood of the whole body, and the overproduction of heat of the stomach and spleen. The granules grow in both the upper and the lower palpebral conjunctiva in the appearance of sago. Pannus (?) or ulcers (?) are the most common complications in the "black eyeball" (cornea) caused by rubbing of the granules. Treatment is by puncture or, better still, cauterization of the granules with a fine needle three or five times. As this disease is due to the heat of the spleen, a prescription is added which may be of great use in driving the heat away from that organ.

"The Most Complete Eye-Book" was written at the end of the Ming Dynasty in 1628 A. D. It is composed of six volumes dealing with 106 kinds of diseases of the eye and treatment by various methods and prescriptions. Almost all native physicians of ophthalmology today look to this book for guidance. It is noteworthy that a procedure for excision of pterygium is minutely described. A date of good luck is always chosen beforehand, and during convalescence the following food should not be taken: fish, fried noodle, chicken, goose, donkey, horse or dog meat, pork, onions, garlic, etc.

Undoubtedly, the practice of ophthalmology in China has been a part of general medicine since the time of Emperor Huang Ti, 2679 B. C. Pi's article gives but a mere outline of the outstanding facts and features of old Chinese ophthalmology, dealing chiefly with the leading articles available to the general readers. Undoubtedly, there are many other sources of information and knowledge that should be investigated.

S. H. McKee.

Lens

THE PART OF THE ENDOCRINE GLANDS IN THE PATHOGENESIS OF CATARACT. VANCEA, Cluj. med., 1929, no. 9.

The author thinks that there is a connection between the endocrine glands and the genesis of cataract, as shown by two cases of his own. In one of them there was cataract in both eyes with concomitant goiter. Operation on the cataract was followed by myxedema. The latter vanished after opotherapy. Another patient, who showed lamellar cataract of both eyes, had goiter, cretinism and biologically demonstrable hypocalcemia.

N. BLATT.

Neurology

HOMONYMOUS HEMIANOPIA: PRIMARY SIGN OF TUMORS INVOLVING LATERAL PART OF THE TRANSVERSE FISSURE. W. I. LILLIE, Am. J. Ophth. **13**:13 (Jan.) 1930.

The anatomy of the basal ganglion as related to the transverse fissure and the optic tract is discussed. The fibers of the optic tract are so concentrated in this situation that a tumor originating in the roof of this fissure may readily cause hemianopia. In thirteen cases observed, the following extra-ocular symptoms were noted: (1) headache, twelve cases; (2) hemiplegia, partial or complete, eleven cases; (3) hemiparesthesia and sensory disturbances, eight cases; (4) nausea and vomiting, four cases; (5) unilateral facial palsy for mimic movements, three cases. Tremors, speech defects, incoordination, ataxia and memory changes were late manifestations. The ophthalmoplegic data were not significantly definite except that the homolateral pupillary light reflex was diminished in six cases, and convergence was diminished in two cases. In two cases there was conjugate weakness of elevation, and in one case homolateral conjugate weakness. There was bilateral choked disk in eight cases. The fields were normal in all but two cases, and in these homonymous hemianopia was the primary sign of an intracranial lesion. In these two cases a diagnosis of tumor of the basal ganglions was made at necropsy but more detailed study showed that they originated in the roof of the lateral part of the transverse fissure.

CASE 1.—A farmer, aged 53, came to the Mayo Clinic because of partial paralysis of the right side. Four years previously, episodes had occurred in which many red spots were seen in the right field of vision. This field later became partially blind. Two and a half years later the patient sometimes said one word when he meant another, and this became progressively worse although he was still able to talk fairly well. Six months later he noticed gradual weakness of the right arm and leg and finally he lost motion in them. The x-ray film showed some evidence of intracranial pressure. The fields revealed a sharp-cut right homonymous hemianopia for form and colors. There was partial right hemiplegia and weakness of the right facial nerve. The patient died suddenly four days after examination. Necropsy revealed a hemorrhagic and necrotic subcortical glioma of the temporal lobe situated in the roof of the transverse fissure and impinging on the left optic tract and left basis pedunculi.

CASE 2.—A farmer, aged 44, came to the clinic because of paralysis of the left side. A year previously his wife noted that he drove his car crookedly, usually pulling in toward the right. She then noted a slight disturbance of speech and following this he complained of difficulty in using a saw and a screw-driver. Four months later he was aware of progressive weakness of the left side. Examination showed a complete sharp-cut left homonymous hemianopia for form and color. The left pupil was larger and did not react to light but did react in accommodation. There were left hemiplegia, mild tremor of the left arm and leg and a moderate degree of aphasia. Right frontotemporal exploration was done without disclosing any signs of tumor. Death occurred three days later, and necropsy revealed a glioma in the region of the right basal ganglion. Sections showed that the main mass of the tumor originated in the roof of the lateral part of the transverse fissure, involved the optic tract and involved the basal ganglion secondarily.

CASE 3.—A carpenter, aged 43, had complained of headaches for the past four weeks. Five weeks previously, while driving his car, he collided with an oncoming car on his left. At the same time his wife noted that the left side of his face was flaccid, and that the right corner of his mouth was drawn to the right. A slight cold developed, and he began to have severe headaches, worse at night, and at times accompanied by vomiting. He became drowsy, and for the last three weeks had some vertigo. He had noticed slightly progressive weakness of the left hand. Examination revealed bilateral acute choked disks, a questionable conjugate weakness to the left and complete sharp-cut left homonymous hemianopia. There was mild left hemiparesis with slight weakness of the left half of the face, mild incoordination of the left arm and leg and left astereognosis. The left temporal area was explored and the brain found under considerable tension; when the cannula was passed through the upper temporal convolution inward and a little upward, a tumor of firm consistency was encountered at a depth of 4 cm. A diagnosis of tumor of the right basal ganglion was made. This probably originated in the roof of the transverse fissure. This conclusion was reached in view of the fact that none of the verified tumors of the basal ganglion observed has produced primary complete homonymous hemianopia.

The clinical data in these three cases support the conclusions of Henschen, Willbrand and Saenger and Cassires, that all focal signs are late manifestations and are due to involvement of adjacent structures, such as the internal capsule, the superior colliculus (anterior quadrigeminal body), the posterior longitudinal bundle, the basis pedunculi and, rarely, the optic tract and external or lateral geniculate body.

W. S. REESE.

PUNCTURE OF THE HYPOPHYSIS: THE METHOD OF HIRSCHMANN AND OUR OWN. J. BOURGUET, Arch. d'opht. **46**:655 (Nov.) 1929.

This procedure has been suggested for the purpose of making a more certain diagnosis in tumors of this area. Whenever possible, the author prefers to avoid the transcranial route in operating on these patients, especially since the tumors situated above the sella are frequently inoperable. He describes the procedure advocated by Simons and Hirschmann,

and objects to it on the ground that it is difficult to carry out and because it is dangerous, in that vital structures may be injured and death result. His own method consists in the endonasal route. It is less inconveniencing to the patient and is free from any external scar. Moreover, the needle can be watched throughout the whole procedure and no traumatism to brain substance occurs.

S. B. MARLOW.

THE MECHANISM OF LESIONS OF THE CHIASM IN FRACTURES OF THE SKULL. H. COPPEZ, Arch. d'opht. **46**:705 (Dec.) 1929.

After presenting three cases which had come under his observation, the author points out that although many cases have been reported in the literature no autopsy has been done in any case explaining the lesions found. Liebrecht, however, reported an autopsy at which a median anteroposterior tear was found in a case in which evidence of visual disturbance had not been obtainable. The same author obtained an autopsy in a case that showed a bitemporal hemianopia, but the optic nerves and chiasm were mislaid.

He points out that the anatomic relationships of the chiasm are such that direct injury to it from the path of a fracture or fragments of bone is difficult. The optic nerves are much tougher than the chiasm and in his opinion are the chief factors in causation of damage to the chiasm.

Injury to the chiasm may be brought about by the optic nerves themselves in three ways: The first by a fracture through the region of the frontosphenoidal junction which results in a spreading apart of the bones at the base and a stretching of the nerves with widening of the angle between them to produce a median tear in the chiasm. Photographs demonstrate the mechanism of the lesion. The second type consists in an anterolateral injury with compression of the orbit, which results in a forward expulsion of the orbital contents, avulsion of the globe and traction on the nerve, damage to the chiasm being caused by the traction of the nerve. The third type results from the transmission of a fracture in the region of the petro-occipital junction to the sphenopetrous junction. The fracture is perpendicular to the optic nerve and it is possible to conceive that the nerve is suddenly and violently torn by the separation of the bones during the blow. This has been demonstrated at autopsy, but the author was unable to produce the lesion experimentally.

S. B. MARLOW.

PATHOLOGY AND THERAPY OF TUMORS IN THE AREA OF THE CHIASM. J. IGERSHEIMER, Klin. Monatsbl. f. Augenh. **84**:161 (Feb.) 1930.

A change in the field of vision is usually the most important ocular symptom in diseases of the area of the chiasm. Bitemporal contractions are predominant but not the rule in tumors of the hypophysis; Josephson, Cushing and Walker found an early contraction of the bitemporal upper quadrants in the early stage of tumors of this body. Bitemporal hemianopic defects of an asymmetrical character are also found in tumors of the hypophysis and its duct, and in glioma, aneurysm and chronic arachnoiditis in the area of the chiasm. On the other hand, in suprasellar meningiomas the intracranial portion of one optic nerve often becomes affected by the intracranial pressure several years before

the other portions. According to Brouwer, primary contraction of the lower quadrants may point to suprasellar tumors. Central scotoma in one eye may occur and lead to the erroneous diagnosis of retrobulbar neuritis. Nasal hemianopia in one eye has been found but homonymous hemianopia is very rare in suprasellar meningiomas, while it is frequently observed in tumors of the hypophysis and its duct. Slight anomalies of the field of vision may be overlooked in these processes, because they are frequently asymmetrical or so limited to relative defects that they become noticeable only in exact examination. The author reports that in one of his cases even exact perimetric examination yielded a slight and varying result; bilateral atrophic foci of the optic nerves were found in this case post mortem. In amblyopia and amaurosis, on the other hand, numerous nerve fibers could be discovered anatomically.

Choked disks, so rarely seen in these diseases, was observed by the author in a case of typical meningioma. Hypophyseal symptoms accompanied by choked disk may render the diagnosis of an actual tumor of the hypophysis doubtful; it may be indicative of another kind of a cerebral tumor with secondary hydrocephalus of the third ventricle, or of a tumor in the area of the chiasm with secondary distention of the sella turcica. Optic atrophy is met with most frequently of ophthalmoscopic changes. One of Igersheimer's cases showed optic atrophy in one eye and choked disk in the other.

Igersheimer recommends roentgen irradiation from four directions and of a dosage of 100 per cent in tumors of the hypophysis; this is to be repeated in smaller doses several times in the course of a number of months, if favorable results were gained by the first exposure. He obtained good results in a number of cases, lasting for varying periods. Surgical intervention may be advisable even in the initial stage. Igersheimer found marked improvement of the central vision, or of the field after one or two irradiations, lasting for several months in decidedly malignant cases. Tumors of the duct of the hypophysis are rarely influenced by irradiation. Patients with cystic craniopharyngiomas, tumors of the duct of the hypophysis and of the Rathke pouch, have been successfully treated by Simons and Hirschmann by means of the puncture of the hypophysis. Surgical intervention is necessitated in meningioma, glioma and aneurysms. The author observed the rare case of a meningioma arising from the sheath of the optic nerve in one orbit.

K. L. Stoll.

Ocular Muscles

A Serious Complication Following Operation for Squint. W. B. Doherty, New York Eye & Ear Infirm. Clin. Rep. **1**: 15 (March) 1930.

A resection and tenotomy had been performed in a physician's office. Ten days later all the sutures but one were removed. All attempts to remove this suture failed. Four weeks later the patient was admitted to the infirmary. The right eye showed a marked convergent strabismus, and over the line of sutures of the resection of the external rectus there was a large papillomatous mass about one-half inch in diameter, from the middle of which appeared a few drops of pus. There was a mucopurulent conjunctivitis. The vitreous was cloudy. The suture was

removed. Hypopyon developed. Diphtheria antitoxin was administered. Purulent choroiditis developed. The outcome was a quiet, blind, convergent eye with normal tension. The case points to the necessity for painstaking technic in the performance of this operation.

W. ZENTMAYER.

TUBERCULOSIS IN THE TENDON OF THE RIGHT EXTERNAL RECTUS. PUSCARIU, Cluj. med., 1929, no. 9.

A child, aged 13, had a tumor the size of a bean on the temporal side of the right eye, immovably fixed on the eyeball. Operation revealed the tumor to be adherent to the muscle tendon. Histologically, fibrous tissue infiltrated by cells was seen in the peripheral portion of the tumor. These cells were of epithelioid type. The center of the tumor was completely devoid of vessels and consisted of epithelioid and some giant cells. Tubercle bacilli were nowhere to be found. The tumor is assumed to be inflammatory, and due to a tuberculous process of the muscle tendon. The case is said to be unique in the literature.

N. BLATT.

Orbit, Eyeball and Accessory Sinuses

THREE CASES OF TRAUMATIC PULSATING EXOPHTHALMOS. D. LAZARESCU and E. LAZARESCU, Brit. J. Ophth. **14:** 162 (April) 1930.

In case 1, a revolver shot penetrated the lower left eyelid of a boy, aged 14. A roentgenogram showed the bullet in the occipital region. A bruit was present. The eye was blind. The mother stated that the eye had always been proptosed. There was almost complete deafness, with facial palsy and paralysis of the left third nerve. Superficial sensibility was disturbed. The knee-jerk reflex was exaggerated. The Babinsky sign was present in the right foot. Ataxia with athetoid movements was present in the right arm. The mental condition was disturbed. There was pulsation in the upper inner angle of the orbit. There was a relative exophthalmos of 19 mm. The diagnosis was arteriovenous aneurysm with injury to the pyramidal tract and direct injury to the third and fifth optic nerves and the gasserian ganglion.

In case 2, a man, aged 34, had left facial abducens palsy following a head injury. Later there was pulsating exophthalmos on the right side. Vision was 7/10. The visual field was contracted. The optic disk was blurred and the veins distended. The arteries were small. Hearing on the left side was subnormal. The right internal carotid was ligated under local anesthesia. There was a return to normal conditions, except for a slight anesthesia of the right side of the face.

In case 3, a youth, aged 19, gave a history of a head injury with symptoms of fracture of the skull. There was an exophthalmos of a slight degree, with pulsation and bruit. Vision was 1/3. The left internal carotid was ligated, followed in four days by right hemiparesis and right facial palsy. There was cessation of the bruit and subsidence of the proptosis. Vision was unchanged. The hemiparesis persisted for more than one month.

The authors believe that postoperative nervous complications are closely connected with the lapse of time that occurs between the appearance of the exophthalmos and surgical intervention; the longer this is, the better is the chance that a collateral circulation will develop. The importance of these complications cannot be overlooked, and it is to be remembered that a hemiplegia may occur, and that after ligation of the left carotid there will be a right-sided hemiplegia which will be a severe handicap to the future wage-earning capacity of the patient.

W. ZENTMAYER.

Pharmacology

EXPERIMENTAL TESTS OF THE BACTERICIDAL POWER OF THORIUM X-DEGEA IN SOLUTION AND IN OINTMENT TOWARD SOME OF THE COMMONER PATHOGENIC ORGANISMS OF THE EYE. C. SPYROPOULOS, Arch. f. Augenh. **100-101**:418, 1929.

The bactericidal power of thorium X was tested against cultures of *Staphylococcus albus* and *aureus, Pneumococcus, Streptococcus, Gonococcus,* the diplobacillus, *Bacillus xerosis* and *Bacillus pyocyaneus.* Twenty-four hour bouillon cultures of the bacteria in question were exposed to various concentrations of thorium X, and then fresh mediums were inoculated and the bactericidal power thus tested.

Relatively large doses of thorium gave a bactericidal effect only when the exposures lasted from eleven to twelve hours. If one considers that in infectious processes in the eye the bacteria are often enclosed in the secretion or in the epithelial cells, it is evident that little effect can be expected from thorium as a therapeutic agent.

F. H. ADLER.

Physiology

THE PERMEABILITY OF THE CORNEA AND THE VITAL STAINING OF THE ANTERIOR SEGMENT, WITH REMARKS ON THE VITAL STAINING OF THE CHOROID PLEXUS. F. P. FISCHER, Arch. f. Augenh. **100-101**: 480, 1929.

A method is described for histologic and titrometric determination of sodium chloride in the cornea. It was shown that by irrigation with solutions of sodium chloride and with solutions free from sodium chloride the salt content of the cornea could be changed. It is not possible to withdraw salt from the cornea in the direction back to front as long as the two cellular layers of the cornea are intact (epithelium and endothelium). On the other hand, sodium chloride can be extracted in the direction from front to back. The peculiarity of this type of permeability depends only on the two cellular layers and not on the substantia propria.

The same is true of various dyestuffs. Acid dyes penetrate the cornea in the direction from front to back, whereas basic dyes do not penetrate in this direction.

In experiments with dialysis through membranes it was shown that acid dyes can be dialyzed better against an alkaline fluid than against neutral fluid, and basic dyes better against a neutral than an alkaline fluid. Certain membrane forces are looked on as accounting for these differences in reaction. Similar processes are probably at play in the cornea.

Various tissues of a rabbit's eye were stained with vital dyes and examined in frozen section, and a comparison was drawn between the effects observed in the eye with those seen in the choroid plexus. The passage of dyes from the blood stream into the acqueous and into the cerebrospinal fluid follows the ordinary laws of dialysis. The different behavior of dyes does not depend on their chemical constitution but on their colloidal state. The degree of dispersement, the charge and the surface phenomena all play a part in determining the fate of any foreign material when injection is made intravenously. F. H. ADLER.

MEASUREMENTS OF HEAT RADIATION FROM THE LIVING HUMAN CORNEA. ERIC ZEISS, Arch. f. Augenh. **102:** 523, 1930.

By the use of the Cobet-Bramigk instrument for measuring heat radiation, the author has measured the heat radiation from human corneas. The advantages of this method compared to the older use of contact measurements with thermometers or thermal elements is discussed. The emission constant of the cornea is similar to that of porcelain, glass and polished marble. The corneal surface undergoes marked changes in temperature, the values being of the order of $\pm$ 1 C., during an interval of thirty minutes. Hot applications such as are usually applied to the living eye by the electrical thermophore or by diathermy are effective for only a short period of time. The temperature of such an eye soon returns to normal. F. H. ADLER.

Refraction and Accommodation

EXAMINATION OF THE EYES, NOSE, LARYNX AND EARS IN 1,468 SCHOLARS. M. SUCIU-SIBIANU, Cluj. med., 1929, no. 9.

The author undertook his investigations in order to ascertain whether there is a certain relationship between refractive errors of the eyes and anomalies of the nasopharynx, larynx and ears. He was able to disclose ophthalmologic, otologic and rhinolaryngologic defects in 41 per cent; viz., myopia, 7.53 per cent; hypermetropia, 7.64 per cent; astigmatism, 0.66 per cent; strabismus, 0.44 per cent; various ocular defects, 2.32 per cent; trachoma, 1.66 per cent; adenoids, 13.19 per cent; hypertrophic rhinitis, 1.77 per cent; hypertrophic tonsils, 4.28 per cent, and otitis, 1.21 per cent. He found eye lesions altogether in 21.5 per cent, and otologic, rhinologic and laryngologic lesions in 48.6 per cent. All the students afflicted with trachoma also showed otologic, rhinologic and laryngologic lesions. Consequently, trachoma arises on a lymphatic basis, associated with handicapped nasal respiration. The author did not, however, find any correlation between diseases of the nose and ears and refractive changes of the eye. N. BLATT.

Retina and Optic Nerve

TAPETORETINAL DEGENERATION OF THE CENTRAL FUNDUS REGION. A. PILLAT, Am. J. Ophth. **13:1** (Jan.) 1930.

The author discusses central retinitis pigmentosa and other forms of tapetoretinal degeneration in the region of the macula and papilla. He reviews the literature on these cases and reports two cases of retinitis pigmentosa centralis with retinitis punctata albescens in Chinamen.

A man, aged 42, complained of being short-sighted since the age of 8, but he had been able to read easily until the fifteenth year. Between the ages of 30 and 40 vision became still worse, and his hearing began to decrease. He had three children living and well; four had died in infancy. His father had good vision but his mother had not seen large objects, like cups, for many years. One of two brothers had the same trouble as the patient.

External examination was negative, except for a few peripheral corneal maculas in each eye resulting from phlyctenular keratitis. Ophthalmoscopy showed a ring-shaped opacity far in front of the disk, which had resulted from a posterior detachment of the vitreous. The disk was yellowish red and somewhat vaguely defined. The veins and arteries were of almost equal caliber and color and were somewhat contracted. In the center of the disk the vessels were blurred by glial tissue. Within a zone of about 3 disk diameters from the disk (4 disk diameters temporally) the choroidal vessels were clearly visible and severely sclerosed. Their color was white next to the disk and light yellow or yellowish red a little farther away, and in the periphery of this zone they were covered by a gray stippled film. The periphery of the eyegrounds was of the homogeneous red fundus without visible choroidal vessels. The intervascular pigment layer of the choroid partly covered the choroidal vessels so that in places the contour lines looked dentate. The pigment epithelial layer also appeared to be absent over an area almost 1 disk diameter around the disk. Beyond this the fundus showed a marked white stippling. The individual dots became larger and dimmer the farther they were from the disk. Outside the diseased zone the white spots still increased in number and size and added a slight grayish hue to the red color of the fundus. These were all behind the retinal vessels. In the peripheral part of the diseased central zone there were some bone corpuscle-shaped or quite irregularly branched black pigment clumps overlying the retinal vessels. In the fovea there was a dark reddish-brown, round spot with irregular contour lines almost 0.75 disk diameter in size. With red-free light the macula appeared to be enlarged and divided into separate areas by white lines. Both eyes were practically the same, and the tension was normal. Vision in the right eye was 2/60; in the left, 2/60; it was improved to 6/10 in the right eye and to 6/15 in the left with concave lenses. The visual field of each eye showed concentric contraction for form temporally and upward, and a big central scotoma which extended to the periphery above. The patient was totally color blind and light sense was 1/9 with the five-point adaptometer (Birch-Hirschfeld).

A second similar case is reported, and the author comments on retinitis punctata albescens occurring with retinitis pigmentosa and on the peculiarities of these cases in particular. He warns against confusing central retinitis pigmentosa with other forms of macular degeneration.

W. S. REESE.

A CASE OF LINDAU'S DISEASE (CAPILLARY ANGIOMATOSIS). A. F. SLADDEN, Brit. J. Ophth. **14**:224, (May) 1930.

A man, aged 37, complained of intense headache following a fall, striking the back of his head, five years previously. A diagnosis of

cerebral tumor was made. The patient died, and at postmortem examination two small tumors were found in the cranial cavity, one a pedunculated growth 1 inch (2.5 cm.) in diameter, external to the left cerebellar lobe, subdural and pressing into this lobe so as to cause softening and yellow discoloration of the cerebellar tissue. Hemorrhage had occurred into the growth. There was a second growth ⅓ of an inch (0.78 cm.) in diameter, not pedunculated, in the posterior part of the right cerebellar lobe. It was soft and whitish. The left kidney contained two dark growths.

The sections from the eye removed twenty years before, for what Coats described as a peculiar granuloma of the retina, were reexamined in the light of later developments, and it was decided that the tumor should be classified as an angioma with an unusually high proportion of endothelial cells.

In the cerebellar and renal tumors the stroma was better defined, loose in texture and much infiltrated, with red blood cells; well formed blood channels were also numerous, and apparently some breakdown of blood cells had occurred with deposition of pigment.

The author makes the following summary: A case of Lindau's disease, with capillary angiomatoma of the retina, cerebellum and kidney, is described. The retinal growth had been removed twenty years previously. The cerebral compression arising from the intracranial tumors became more manifest after a blow on the head five years before death. There was some evidence of faulty development of the skull. No history was obtained of similar conditions in the patient's family.

W. ZENTMAYER.

RELATION BETWEEN DETACHMENT OF THE RETINA AND GENERAL AND LOCAL DISTURBANCE IN THE CAPILLARIES. J. F. DECKER, Arch. f. Augenh. **100-101**:223, 1929.

Sixteen cases of myopia were examined in a routine manner for disturbances of the capillaries by the method of Siebeck. This consists in the drinking of large quantities of distilled water, following which determinations are made of the hemoglobin and of the quantity and specific gravity of the urine over a considerable period of time. In 25 per cent of the cases of detachment of unknown etiology he found a disturbance in the general capillary system of the body. Intra-ocular tensions recorded on these cases during the investigation showed an increase in intra-ocular pressure in the eye with the detachment, from which he concludes that in these cases there is a local disease of the capillaries.

F. H. ADLER.

ON THE QUESTION OF FAMILIAL DETACHMENT OF THE RETINA. H. SCHMELZER, Arch. f. Augenh. **100-101**: 268, 1929.

The author describes the cases of five sisters of one family with moderate myopia, in three of whom, between the ages of 18 and 25, there occurred a unilateral, flat detachment of the retina without tears. This occurred in the periphery of the eye with the presence of areas of

chorioretinitis. Similar areas of chorioretinitis were found in the father and in one of the two remaining sisters without detachment.

The question of the causation of the detachment is discussed on the basis of inheritance and bodily structure.

F. H. ADLER.

Trachoma

THE ELECTROLYTIC EQUILIBRIUM BETWEEN CALCIUM AND POTASSIUM IN THE SERUM OF PATIENTS WITH TRACHOMA. V. ROSSI, Arch. di ottal. **37:** 13 (Jan.) 1930.

Rossi is a former assistant of Angelucci, whom he has just succeeded as editor of the *Archivio di ottalmologia.* In this work he carries out further investigation on the relation between trachoma and constitution begun in Angelucci's clinic. This seemed to show that trachoma affects especially persons with various signs of glandular imbalance pointing to a predominance of the vagus over the sympathetic nervous system, the so-called vagotonic type. Rossi now reports on the blood chemistry in thirty cases of trachoma in adolescents, attention being directed especially to the relative amounts of calcium and potassium. In the more severe cases of trachoma, with corneal complications, a deficiency in calcium with relation to potassium was observed, for example, 10.15: 24.87 mg. per hundred cubic centimeters. These often showed other signs of the exudative diathesis. In otherwise normal children, with mild trachoma, the relation was more often normal, 10: 20 mg. per hundred cubic centimeters. This relative hypocalcemia is what would be expected in vagotonic persons. Only one examination was apparently made in each case, and no series of normal patients examined with the same technic is reported. Such a series would have given more weight to Rossi's conclusion that hypocalcemia is an important predisposing cause of trachoma.

S. R. GIFFORD.

Tumors

CHOROIDAL SARCOMA TREATED BY THE INTRAOCULAR INSERTION OF RADON SEEDS. R. FOSTER MOORE, Brit. J. Ophth. **14:** 145 (April) 1930.

The fact that a patient refused to have an eye with a choroidal sarcoma removed as the other eye was blind is the author's reason for carrying out treatment of so experimental a nature.

A man, aged 65, had recently noticed a pigment mole on the right nipple. The urine contained no melanin. Sight had been failing for six weeks. The mass was in the lower part of the globe. There was a star-shaped opacity in the posterior part of the lens. Vision equaled 6/60. The radon seed used was of 1 millicurie strength and was filtered through 0.5 mm. of platinum. A conjunctival flap was reflected and the seed inserted directly into the thickest part of the growth so that, if possible, the radon would be imbedded in it. The incision through the sclerotic coat was just large enough to admit the seed. The knife was thrust into the globe. The radon was taken in a pair of finely ribbed forceps and inserted straight into the growth.

Some headache and periodic shooting pain was present, and one posterior synechia formed. The seed was removed fourteen days after its insertion. There was still brownish color under the conjunctiva in the region of the scleral incision. This was produced by little colonies of pigmented cells which were tracking, as it were, from the region of the incision in the sclerotic. They disappeared completely.

As some shrinkage of the growth was noted, a second seed of 5 millicuries with 0.5 mm. of platinum was inserted at the same spot, four months later. It was removed after ten days. Three months later the opacity of the lens had disappeared. At first the growth was slow to undergo change, but one year after the first treatment it had become so shrunken that it was seen with difficulty, and then only by looking right down behind the iris. It had lost its tense globular shape and appeared shrunken and of an irregular surface. It was of a dull ashen gray color instead of the dense dark color noted previously. Tension was normal. The field was somewhat increased in size. Seven months after treatment was begun, vision was 3/60.

From this experience the author thinks that it may be said that an intra-ocular melanotic sarcoma can be made to shrink greatly and perhaps disappear by this treatment. He asks whether with the commencement of the shrinkage one is justified in assuming that the danger of dissemination ceases from that time. His answer is that no authoritative reply can be given, but judged on general principles it seems unlikely that actively growing cells will be thrown off from a tumor that has begun to regress, and that as soon as the radon has had its effect perhaps the danger of dissemination ceases.

W. ZENTMAYER.

LEUCO-SARCOMA OF THE IRIS. W. S. DUKE-ELDER and H. B. STALLARD, Brit. J. Ophth. **14:** 158 (April) 1930.

The author states that primary sarcoma of the iris is a relatively rare condition, and that although there may be little fundamental pathologic difference between tumors that contain pigment and those that do not, the greater rarity of leukosarcoma makes the occurrence of such cases more interesting.

A man, aged 68, complained of visual failure which had been progressive over some months and which affected especially the left eye. There was incipient cataract in each eye. The right eye showed a raised circular tumor about 3 mm. in diameter, situated at 9 o'clock in the middle of the anterior surface of the iris. The tumor was yellow-white, was richly vascularized and showed numerous vascular loops on its surface. That it had to some extent infiltrated the surrounding tissues was suggested by the fact that the pupil was flattened in this region and this section of the iris failed to react to a mydriatic. The tumor was removed by iridectomy, but the eye was later enucleated when the pathologic report showed its nature.

Fourteen months later, the patient was still well. The growth was made up of spindle-shaped cells arranged mostly irregularly, but in places disposed in interlacing bundles. It was very cellular and without connective tissue or mitotic figures. There were many widely dilated blood channels with walls of a single layer of endothelial cells. There was no trace of pigment throughout the entire tumor. The neighboring iris stroma was infiltrated.

The author found twenty-five cases of primary sarcoma in the literature. Fourteen were in males and twelve in females, ranging from 1 to 75 years in age. The lower and lower temporal sector of the iris was the most frequent site. The shape varied: nodular, diffuse, globular and pedunculated. Obvious vascularity was noted in six cases. Nine specimens were of the spindle cell type, three were of the round cell, and six of the round and spindle cell type. Glaucoma supervened in two cases. Six showed infiltration of surrounding structures.

The indications for iridectomy may be stated thus: When the neoplasm is small, well defined, situated at or near the pupillary margin of the iris, and not encroaching on the ciliary border of this tissue; when the intra-ocular tension is normal, the vision of the affected eye good, and when iridectomy provides facilities for complete removal, a circumstance which can be verified subsequently on pathologic examination of the excised portion of the iris. Continuous supervision of the patient afterward is implied, otherwise the eye should be enucleated, a course which is probably safer in all cases.

The prognosis after excision appears relatively good, provided the neoplasm does not extend along the perivascular sheaths of the ciliary vessels.

W. ZENTMAYER.

AN UNUSUAL CASE OF NEURO-EPITHELIOMA OF THE RETINA. D. G. PATWARDHAN, Brit. J. Ophth. **14:** 297 (June) 1930.

The patient was a boy, aged 6. Six months previously the left eye had been injured, resulting in a perforation of the globe with total loss of sight. Soon thereafter a rapidly growing tumor developed at the site of the injury. The mass was as big as a coconut, having a circumference of 15 inches (37.54 cm.). It had a stalk originating in the globe, and was not attached to the surrounding tissues. Histologically, it had the characteristics of a neuro-epithelioma (retinoblastoma) without rosets. The unusual features were the size of the tumor and its rapid growth.

W. ZENTMAYER.

Uvea

THE REPORT OF A CASE OF BILATERAL SARCOMA OF THE UVEAL TRACT. F. W. SHINE, New York Eye & Ear Infirm. Clin. Rep. **1:** 31 (March) 1930.

A man, aged 35, gave a history of a small black birth mark at the lower part of the pupil of the right eye. Five years previously he was struck by a firing pin of a rifle, from which he recovered with vision slightly impaired. The lower outer quadrant of the iris was the seat of a small brownish-black deeply pigmented mass protruding into the anterior chamber. A diagnosis of sarcoma was made and removal of the eye advised. The left eye was normal.

The affected eye was removed five months later by another surgeon. The pathologic report was melanosarcoma of the iris. The patient was seen again three years later with a growth of the choroid of the left eye. Secondary glaucoma supervened, and the eye was enucleated. The growth proved to be a sarcoma. The patient died about four years later of "a tumor of the abdomen, melanotic sarcoma."

The author finds but seven reported cases of bilateral sarcoma of the uveal tract.

W. ZENTMAYER.

ALBUMINURIC CHOROIDITIS. A. FUCHS, Klin. Monatsbl. f. Augenh. **84**:39 (Jan.) 1930.

Changes of the pigment epithelium, accompanying albuminuric retinitis, may justly be called albuminuric choroiditis. This condition develops in chronic nephritis and also in malign nephrosclerosis. Four ophthalmoscopic types are distinguished by the author, who reports in detail the pathologic and anatomic conditions in two cases.

The first case showed pigment changes over the choriocapillary vessels, a large area of fatty degeneration, involving the inner retinal layers, varicose nerve fibers, atrophic and hypertrophic patches in the pigment-layer and, finally, solid accumulations of epithelioid cells located in the central layers of the choroid with proliferation of the pigment on the pigment layer. These "pigment-buttons" were also found in the pigment layer, adjoining vessels with hyaline degeneration of their walls. The second case showed Siegrist stripes and typical Elschnig foci; it gave evidence of the close relation between the latter and the pigmentation resembling pearl-strings. Some of the fine pigment spots on the yellowish choroidal vessels were surrounded by brighter hued circles, making it appear as if the diseased vessels were dotted with Elschnig foci. These changes are indicative of degeneration of the vessels, but not necessarily of an unfavorable prognosis. The presence of Elschnig foci seems to indicate a shorter duration of life than Siegrist stripes. Albuminuric chorioretinitis, in the author's opinion, is not due to degeneration of the vessels of the retina, but to some toxic agent.

K. L. STOLL.

Sympathetic Ophthalmia

TWO CASES OF SYMPATHETIC OPHTHALMITIS. D. J. WOOD, Brit. J. Ophth. **14**: 291 (June) 1930.

The first case was that of a colored boy who was wounded by a piece of wire. There was a wound of the cornea with prolapse. The prolapse was cut off and a conjunctival flap drawn over the wound. After two weeks the iris had changed color and was pushed forward. Tension was minus. There was no redness or precipitates. The eye was enucleated three weeks after the injury. Two weeks later the remaining eye was the seat of an inflammation which persisted, and at the end of a year there were the sequelae of iridocyclitis.

In the exciting eye the dominant feature was a leukocytic extravasation with a few collections of lymphocytes and very few plasma cells. The retina had suffered more than would have been expected. The nerve fibers and ganglion cell layers were destroyed and leukocytes were present as far back as the rods and cones. Except for a few collections of lymphocytes, this condition was not typical of sympathetic disease; nevertheless, it produced a condition in the other eye which was quite typical.

The second case was that of a woman, aged 50. As a result of an injury in early life, there was a cystoid cicatrix in the left eye with an updrawn pupil. The lens was cataractous. It was removed without iridectomy. During convalescence an examination made because of a self-inflicted abrasion of the cornea showed a few precipitates on the

back of the cornea. These were transitory. Later a discission of the capsule of the lens was done, with a resulting vision of 6/6. Three weeks later iridocyclitis developed in the right eye. About seven months later, it was excised. The left eye was free from inflammation.

A detailed description with a number of illustrations of the histopathology of the exciting eye is given. There was an absence of leukocytes, with some lymphatic collections and much plasma cell formation.

From the first case the author concludes that one does not do all that is necessary in removing a possibly dangerous eye unless one makes a careful slit-lamp examination of the remaining eye before the patient leaves the hospital and afterward until safety is assured.

W. ZENTMAYER.

Society Transactions

EDITED BY DR. GEORGE S. DERBY

THIRTEENTH INTERNATIONAL OPHTHALMOLOGICAL CONGRESS

Amsterdam, the Netherlands, September, 1929

ABSTRACTED BY PERCY FRIDENBERG, M.D.

(Concluded from page 144)

TUBERCLE BACILLI IN THE BLOOD IN DISEASES OF THE EYE. DR. URBANEK and DR. MELLER, Vienna, Austria.

In connection with a possible tuberculous origin of uveitis a large number of patients were tested, and cultures and animal inoculations carried out. In seventy cultures, one was positive; there were eight positive results with animals, three showing typical tuberculous changes, and in five cases a previously negative tuberculin reaction became positive. In one case of iridocyclitis in which the animal test was positive, gonitis with tubercle bacilli developed a year later, and there was a relapse of the iridocyclitis.

DISCUSSION

DR. BARGY, Avallon: The sediment of urine, removed under aseptic precautions and centrifugated, leads much more easily to the detection of circulating tubercle bacilli and to a conclusion as to the tuberculous nature of a uveitis than examination of the blood or inoculation. I had positive results in five cases.

THE RÔLE OF AGE AND SEX IN PHLYCTENULAE. DR. WEEKERS, Liége, Belgium.

The hypothesis that a tuberculous allergy is the basis of these efflorescences seems to be supported by the susceptibility of the female sex (72 per cent), which reacts to antigens much more quickly and intensely than the male. Phlyctenules are rare in the first year, and most frequent in the second; 50 per cent of the patients up to 10 years of age were females, as were 76 per cent of the group from 11 to 16 years. After puberty, the frequency diminishes in both sexes, more rapidly in the male. Toward the menopause the females show a marked recrudescence of limited extent (? P. H. F.).

DISCUSSION

DR. HONA KRASSO: The phlyctenule curve, as noted at the Vienna clinic, rises sharply in the second year, with a peak at the third and fourth. The highest point, however, is not reached until the fifteenth year, after which there is a sudden, marked drop.

DR. BRUCKNER, Prague, Czechoslovakia: Aside from the tuberculous allergy, we may be dealing with a bacillary allergy, either as endogenous or exogenous infection in an allergic field. In my histologic studies of the permeability of the conjunctiva for germs, tubercle bacilli instilled into the conjunctival sac of rabbits produced a chronic catarrh in the course of which the germs were taken up by phagocytes and transported under the epithelium. Small cell infiltration or granular inflammation then takes place in the submucosa. The germs gradually fail to take stains and finally disappear completely, so that absence of micro-organisms does not speak against tuberculosis.

DIAGNOSTIC DIFFICULTIES IN OCULAR TUBERCULOSIS. DR. COSMETTATOS, Athens, Greece.

Dr. Cosmettatos gave the initial tuberculous changes in the iris and ciliary body, a description of various intra-ocular processes the tuberculous nature of which could not be determined until later from the course of the disease and the effect of antituberculous treatment, and the histopathologic observations on an eye enucleated for tuberculosis with initial changes in the iris and ciliary body. The presence of cells with acidophil granules in the protoplasm was given as the first phenomenon of inflammation in tuberculosis of the anterior portion of the uvea.

THERAPEUTIC FACTORS AND RESULTS IN OCULAR TUBERCULOSIS. DR. WERDENBERG, Davos.

The means of recognition of the tuberculous character of the disease of the eye and of intrathoracic and general disease was given, with statements of the value of climatic and high altitude (mountain) cures, specific medication, roentgen therapy and subconjunctival injections of salt solution. Statistics showed 153 cases of tuberculous iridocyclitis, 50 cases of tuberculosis of the choroid, 15 of the retinal veins and 12 of the optic nerve. The results were: improvement of vision in 72 per cent, anatomic healing of the ocular tuberculosis in 60 per cent, improvement in 34 per cent and healing or improvement of the tuberculous mediastinal glands and constitutional disease present in 35 per cent of the eye cases. The injection of tuberculin (156 cases) and roentgen therapy (201 irradiations of 54 eyes) were useful in 50 per cent, without effect in 30 per cent and temporarily harmful in 20 per cent, in spite of careful dosage. Subconjunctival injections (255 eyes) of salt absorbed exudates and improved vision in four fifths of the patients treated.

DIFFERENTIAL HEMATOLOGY IN OPHTHALMIC PRACTICE. DR. ORAM RING, Philadelphia.

The method is of value in functional, nonprimary, disturbances of vision to determine the cause and indications for treatment, operative or conservative, as well as in investigation of the etiology of organic disease, especially of the uvea, to decide whether an operation can be performed without probable danger, and to clear up the nature of postoperative complications.

DISEASES OF THE EYE IN ANKYLOSTOMIASIS AND PELLAGRA. DR. RIAD, Cairo, Egypt.

These diseases are rife among the Egyptian peasants (fellahin). There are lowered vision, diplopia, asthenopia, contraction of the visual field for form and color, nyctalopia and hemeralopia, retinal hemorrhages, optic neuritis and juvenile cataract. The last-named condition is often seen in children about the age of 6, and has a decidedly progressive character. The operative results are good.

DISCUSSION

DR. P. A. JAENSCH, Breslau, Germany: Of late, pellagra has been seen rather frequently in Germany, particularly in insane asylums. In two cases I noted hyperemia of the disk with some blurring of the margin but without diminution of vision. The fundus conditions became normal as the pellagra was cured. In a third patient, under observation for nearly two years, there was double papillitis progressing to optic atrophy in the right eye, and an almost complete return to normal in the left. Absolute central scotoma was noted in both eyes, which also improved under treatment. A definite picture of atrophy did not develop until after several relapses of pellagra.

ANAPHYLACTIC CONJUNCTIVITIS. DR. LAGRANGE, Paris, France.

Hypersensitivity to plant or animal albumin (protein? P. H. F.) may cause inflammations with the typical picture of spring catarrh. The latter is often due to a neuro-arthritic diathesis, and is anaphylactic, just like asthma and hay fever. In one of my cases there was susceptibility to green wood, causing conjunctivitis.

ADENOIDS AND APPENDICITIS IN ADOLESCENT FOLLICULAR CONJUNCTIVITIS. DR. TERSON, Paris.

In 75 per cent of the cases there were enlarged palatine and pharyngeal tonsils. Appendicitis was present in more than half of the cases. Signs of tuberculosis and syphilis were common. The condition of the eye is often mistaken for an infectious conjunctivitis.

EXPERIMENTAL STUDY OF THE PERMEABILITY OF THE LENS CAPSULE IN THE ETIOLOGY OF SENILE CATARACT. DR. FRIEDENWALD, Baltimore.

This article appeared in full in the February issue of the ARCHIVES (3: 182, 1930).

DISCUSSION

DR. A. LOEWENSTEIN, Prague, Czechoslovakia: An intact lens capsule is a sine qua non for a transparent lens. The capsule is a colloid and follows all the laws for that substance. Aging is a basic property of colloids, owing to loss of fluid, with marked molecular transpositions which must greatly alter permeability. In a large series of experimentally induced cataracts no marked differences were found, chemically, between intact and injured capsules.

DR. S. R. GIFFORD, Chicago: Glutathion, the cystin-containing substance that controls the thermolabile soluble system in the lens is markedly diminished in the nucleus of the cataractous lens. This is not due, as I thought formerly, to dialysis through the more permeable lens capsule and off-flow through the anterior chamber, but its normal production is checked by deleterious substances which form in the senile lens. A similar reduction is found in naphthalin cataract of rabbits. If the intact lens capsule is as permeable as Friedenwald claims, it is hard to explain the sudden and marked changes and opacification after the capsule is opened by operation or injury.

DR. FRIEDENWALD: Traumatic cataract cannot be explained by the mere imbibition of fluid and electrolytes. I cannot agree with Dr. Loewenstein's view of alterability of the lens capsule, which I have kept unchanged in physiologic solution of sodium chloride for weeks. Changes of the p_H, too, appear to have little or no effect. Further studies of fluids, dextrose and other sugars confirm my hypothesis.

THE MORPHOLOGY OF THE PATHOGENESIS OF CATARACT. DR. KUBIK, Prague, Czechoslovakia.

The weights of 433 human cataracts were compared with the weights of clear lenses, and the relation of the specimens to various forms of cataract was studied. The dry residue in eighty cases gave no unequivocal evidence, in weight, of a uniform pathogenesis of the various forms of cataract. For supranuclear and nuclear forms, at any rate, we must propose different modes of development.

THE RÔLE OF THE ZONULE IN INTRACAPSULAR EXTRACTION (FILM). DR. POYALES, Madrid, Spain.

Capsule forceps like Kalt's, Colonel Smith's hook and Barraquer's erysiphak can be used to rupture the zonule by vibration. The first has its point of resistance in the zonule and its point d'appui in the capsule. To tear the zonule, this membrane must offer less resistance than the capsule. It is useful in extracting, in the capsule, cataracts in which the nucleus still allows a fold of capsule to be picked or grasped (Morgagni's, immature cataract) and in which there are sclerosis and atrophy of the zonular fibers, and cataract with a small nucleus. The patients are from 60 to 70 years of age. Colonel Smith's hook has its resistance in the lens system as a whole. No marked resistance of the capsule is requisite. We need merely definitely demonstrable sclerosis of the zonule, complete (mature) cataract with a large nucleus, and forms without swelling due to imbibition. Barraquer's suction instrument has its counterpoint in the lens. Its application requires zonular sclerosis, but suits the largest number of intracapsular extractions (immature, nuclear or capsulocortical forms). In traumatic, soft, juvenile or intumescent (imbibition) cataract we must use some other procedure than intracapsular extraction.

QUININE AMBLYOPIA WITH AN UNUSUAL FUNDUS PICTURE. DR. DUGGEN and DR. NAVATI, Bombay, India.

Two cases of sudden blindness were observed, showing marked retinal edema with normal nerve and vessels. Vision was restored to

normal in from two weeks to one month, with permanent contraction of the visual fields.

PULSATIONAL VARIATION IN THE WALL OF THE GLOBE. DR. WEGNER, Greifswald, Germany.

Uniform compression of the globe reduces the difference between intra-ocular and extra-ocular pressure and increases the elasticity of the cornea and the sclera. The elastic caliber variations of the intra-ocular vessels reach a maximum when under this pressure the increased intra-ocular tension approaches the diastolic pressure of the intra-ocular vessels. The variations register in the elastic corneosclera and can be shown graphically by a simple apparatus in the form of pulsations synchronous with the carotid pulse and showing, like the latter, primary, main and secondary waves under suitable pressure. Provocative tests with posture and caffeine and congestion tests (Thiel) show an increase in pressure in glaucoma or a tendency thereto, with negative results in normal eyes.

THE GENESIS OF PULSUS OCULI. DR. SAMOILOFF, Moscow, Russia.

Manometric studies were made of marked pulsational oscillation of intra-ocular pressure in rabbits in reactive hypertonia, coming on immediately with stimulation while intra-ocular tension was still low, accompanying the increase of tension and disappearing at its maximum. Similar observations were made after the subconjunctival injection of pilocarpine while the tension was low rather than high. The curves of eye pressure therefore cannot be, as is generally supposed, plethysmographic. The volume of the globe is not invariable. In hyperemia of the uvea a certain amount of fluid flows off from the anterior chamber, thus regulating intra-ocular tension. The aforementioned pulsatory oscillations do not depend on lowered blood pressure or on increased intra-ocular tension, but on reflex hyperemia of the uveal tract. This new theory may help to explain the mechanism of the lowering of tension by pilocarpine and the marked variation in its efficacy in various forms and cases of glaucoma, probably depending on greater or less interference with off-flow from the anterior chamber.

DAY CURVE AND LOADING TEST IN THE DIAGNOSIS OF GLAUCOMA. DR. SALLMAN, Vienna, Austria.

Variations in intra-ocular tension in the course of the day are due to the action of the external ocular muscles. Seidel's dark test with a slight increase of tension after the exclusion of light indicates that the latter acts as a result of the complete absence of muscle action (? P. H. F.) while the patient is kept in the dark. This test does not give any practical aid in the choice of operation or a prognosis of the result of surgical intervention. Patients giving a negative dark test may show a pathologic increase of tension after the provocative injection of caffeine. Other "loading" tests with fluorescein, posture-congestion and heat-irritation are of little practical value. Congestion tests were given up, as they produce such marked overfilling of the blood vessels of the head that there is danger, particularly in elderly subjects, of cerebral hemorrhage.

PATHOLOGY OF THE ANTERIOR CHAMBER. DR. ORTIN, Madrid, Spain.

The anterior chamber is a serous cavity of mesoblastic origin with an endothelial (Descemet's membrane, iris) lining. It has anatomic and physiologic characteristics and functions analogous to those of the other serous cavities (abdominal, articular, intracranial). A pathologic correspondence is to be expected, and does exist. Thus there is a primary as well as a secondary inflammation of Descemet's membrane, serositis of the anterior segment. Intoxications and disturbances of metabolism and digestion are etiologic factors. The slit-lamp shows edema and clouding of the endothelium without any other changes. Symptoms are limited to feeling of pressure or heaviness, with slight photophobia and tearing, and at times some circumcorneal injection. This is generally bilateral, and lasts from five to ten days, but may be obstinate and run a chronic course with a tendency to relapse. Again, this may be accompanied by, or pass over into, a mild secondary iritis.

GONIOSCOPY, PARTICULARLY IN GLAUCOMA. DR. URIBE TRONCOSO, New York.

In the examination of the angle of the anterior chamber in the living eye I use an apparatus that is a combination of microscope (magnification 13-32) and periscope, with strong electric illumination. Through a coloboma, the ciliary processes and the orbiculus ciliaris can be seen up to the ora serrata.

SYMPATHETIC VASOMOTOR REFLEX AFTER OCULAR IRRITATION. DR. FEIGENBAUM, Jerusalem, Palestine.

In normal and glaucomatous eyes there is a reduction of intra-ocular tension in the fellow eye as well as in the one illuminated. This does not depend on consensual pupillary contraction but on direct irritation and stimulation of the vascular apparatus acting on the uvea. This is proved by cases of positive reaction in which, for one reason or another, there was pupillary immobility, or in which the illuminated eye was blind. Opticociliary neurectomy in three cases of painful unilateral absolute glaucoma seemed to show that the operation had blocked the path of this reflex from one eye to the other. In cases of absolute glaucoma with atrophy and finally lowered tension, with atrophy of the iris and secondary cataract, the reflex fails to appear on account of degeneration of the nerve receptors. (Curves were demonstrated.)

DISCUSSION

DR. WEEKERS, Liége, Belgium: Variations in the tension in one eye may be experimentally induced by cauterization or bruising (Quetschung), by the method of Leplat. This is a kind of consensual ophthalmotonic reaction, and is of vasomotor origin. In the same way injury of the joint of an extremity in dogs causes vasomotor reactions in both legs.

PHYSIOLOGICALLY ACTIVE SUBSTANCES IN OCULAR TISSUES. DR. K. VELHAGEN, JR., Halle, Germany.

Extraction methods showed the presence in all parts of the uvea of a substance with all the characteristic properties of Haberlandt's heart

hormone. Various organ extracts have a similar effect, and the term "hormone" should not be used for such substances, which seem to resemble histamine, and possibly are essential for normal function.

DISCUSSION

DR. HAMBURGER, Berlin, Germany: I was unable to isolate from bullocks' eyes a hormone for pupillary action.

RÔLE OF THE SYMPATHETIC IN GLAUCOMA. DR. BISTIS, Athens, Greece.

Adamueck's experiments and Jonnesco's surgical procedures support the hypothesis of a sympathetic nerve factor in glaucoma. Faradism of the cervical sympathetic in rabbits raised the tension from 5 to 10 mm. of mercury, as measured by the Schiötz tonometer. Irritation of vasodilators in the sympathetic is communicated to the intra-ocular vessels. Their dilation causes increased tension communicated to the vitreous and sclera. For actual development of glaucoma, however, one needs a terrain predisposed by rigidity of the sclera, anomalies of refraction, arteriosclerosis or disturbance of the endocrine glands.

DISCUSSION

DR. THIEL, Berlin, Germany: In man the data are the same as in animal experiments, i.e., a rise followed by a drop in tension and due to contraction of the uveal vessels. After irritation of the sympathetic, variations in pressure are very slight in normal eyes but marked in glaucoma, and are bilateral, no matter whether the stimulus is mechanical, thermic or due to roentgen rays applied to the superior cervical ganglion, sphenopalatine ganglion or eardrum.

NEVUS FLAMMEUS WITH GLAUCOMA AND HETEROCHROMIA. DR. WAARDENBURG, Arnhem, the Netherlands.

A direct causal relation is indicated by homolateral or bilateral occurrence. In thirty cases hypertension did not lead to hydrophthalmus but was manifest as simple or prodromal glaucoma. There is probably a plethora of intra-ocular blood vessels like that in the skin. Differences of pigmentation and of stroma development in the two irides were also noted. These anomalies are not due to the glaucoma, but are expressions of a coordinated developmental asymmetry which requires further investigations.

DISCUSSION

DR. THIEL, Berlin, Germany: I found the factor of vascular anomaly in a case of nevus flammeus with simple glaucoma presenting telangiectatic choroidal veins which dilated to broad blood streams when the veins of the neck were subjected to compression. In another case severe convulsions like those in jacksonian epilepsy were attributed with probability to telangiectases of the meninges. An exceptional reaction of the eye to inflammations (iritis, iridocyclitis) in the form of lowering of tension (Hamburger) could not be confirmed. Against this theory are the severe forms of glaucomatous serous iritis and the frequent increase

of tension in iritis secondary to corneal inflammation. Parenchymatous keratitis is occasionally complicated by hydrophthalmos or simple glaucoma.

Dr. A. von Roetth, Budapest, Hungary: Many clinical details point to a developmental defect of the cervical sympathetic as the etiologic factor in glaucoma with nevus flammeus. The fiery mole itself follows the sensory nerves of the skin and not the distribution of the blood vessels. There is no disturbance of sensibility, but the sympathetic fibers of the skin of the face run along with those of the trigeminal nerve. Further suggestive features of sympathetic lesion are heterochromia, increased moisture, hyperhydrosis, more massive bones on the affected side and corresponding dilatation of the vessels of the iris and the retina. Disease of the ophthalmic terminals of the sympathetic may cause increased intra-ocular tension in two ways: (1) by disease of the vasomotors causing dilatation of the capillaries of the ciliary body and choroid; as capillary microscopy has shown that there is discord of function and retarded circulation in fiery mole, this leads to glaucoma; (2) the trophic fibers of the ophthalmic sympathetic may become diseased, generally during fetal life; the result is developmental defect and consecutive hydrophthalmos. In this category must be included the cases of facial hemihypertrophy or neurofibromatosis with hydrophthalmos. In a case of fiery mole with glaucoma, a roentgenogram revealed marked pathologic changes in the left occipital lobe, sharply limited in the median line, presenting as a mass of brain convolutions, pia mater with chalky degeneration, and enlarged and chalky vessels. Vascular changes on the brain surface coordinate with the fiery mole may have given rise to the right spastic hemiparesis and homonymous hemianopia.

Dr. J. Bistis, Athens, Greece: Heterochromia is due to a lesion of the cervical sympathetic. The disintegrated iris pigment obstructs the filtration angle and in this way causes increased intra-ocular tension. Glaucoma in fiery mole is due to overfilling of the eye with venous blood. In iritis, the plethora is due to arterial blood, which differs not only in gaseous (oxygen, carbon dioxide) content, but in solid substances as well.

Dr. P. C. Hamburger, Berlin, Germany: Increased tension is unusual in iritis, or it is a mild form which promptly yields to treatment and offers a favorable prognosis. The eye is almost the only organ that softens when inflamed. If it were not for this splendid defensive mechanism, the eye would be lost through glaucoma in every case of acute injury or intra-ocular inflammation.

Dr. A. Loewenstein, Prague, Czechoslovakia: Few ophthalmologists will agree with Dr. Hamburger that iritis and glaucoma are mutually exclusive, or that increased intra-ocular tension in iritis is insignificant or of no importance. On the contrary, these clinical forms show no tendency to spontaneous regression. Experimental heterochromia certainly exists (Bistis), and I have proved this in dark rabbits, in spite of Poos' statement that the condition was simulated by pupillary variation. The slit-lamp shows clearly that the change to a lighter color is not due to the stretching and thinning of the iris with sphincter contraction, but that it persists in mydriasis.

DR. A. BRUECKNER, Basle, Switzerland: The slit-lamp observation of heterochromia due to unilateral resection of the sympathetic was corroborated in experiments on a large number of rabbits.

DR. WAARDENBURG: I note the consensus as to the interrelation of fiery mole and glaucoma. Heterochromia to which I called attention was the third new concomitant. I do not believe that it was due to sympathetic disturbance, as paresis produces definite hypoplasia and hypochromia visible with the slit-lamp in all parts of the iris. The facts that in nevus flammeus we have just the opposite pigmentation conditions, viz., hyperchromia and hyperplasia, and that all other symptoms of Horner's syndrome are lacking make the theory of trophic disturbance very improbable. There is no proved relationship between nevus flammeus and any particular nerve area, either embryologically or dermatologically, and in my cases it was not possible to find any uniform distribution of either sensory or sympathetic fibers in correspondence with the blood vessel distribution. Nevus and ocular changes are expressions of a unilateral hyperplasia which may be due to neurotrophic disturbances, vascular anomalies or both. We do not know which is the primary factor, or whether they may not both be merely partial expressions of a single general cause.

LATE INFECTION AFTER GLAUCOMA OPERATION. DR. MORAX, Paris, France.

In all surgical procedures that produce a fistula, there is sooner or later, in a small number of cases, an exogenous infection as a complication, which rapidly spreads to the iris and vitreous. This has caused exaggerated fear of the operation, although the etiology has not been studied. My few cases showed a small anaerobic bacillus which was pathogenic for animal eyes. We must not let the possibility of these rather infrequent late infections deter us or make us forget how hopeless the prognosis of chronic glaucoma was before the time of sclerectoiridectomy.

DISCUSSION

DR. ABRAMOWICZ, Vilna, Russia: I observed 200 cases, during three years, in which Szymanowski's "Demi-Elliot" method was used without a single late infection, even in one patient who acquired purulent conjunctivitis.

DR. BONNEFON, Bordeaux, France: I have seen practically no late infections in Bordeaux, and I remember none in Lagrange's service (from 1908 to 1912). From 1919 to 1929, I saw only one case of mild benign infection (in 200 cases) six months after Lagrange's operation. As a matter of fact, the procedure is not a fistulizing operation but forms a kind of pore which reestablishes the hydrostatic equilibrium. A cystoid filtering scar, on the other hand, is obviously always exposed to late infection.

DR. DUPUY-DUTEMPS, Paris, France: Morax has given us some rather indefinite measures to prevent late infection. The question is what to do in the actual presence of this complication. I close the fistula with a conjunctival flap covering after freshening up the area, e.g., with the galvanocautery. This often stops the infection, and it is

remarkable that intra-ocular tension does not rise again although the fistula has been closed (? P. H. F.).

DR. COMBERG, Berlin, Germany: Late infections were noted rather frequently in Germany at first after Elliot's operation. Now that we keep the fistula out of the lid fissure area and raise up a thicker flap, they are much rarer (1 per cent, University Eye Clinic). The infection generally remains limited to the region of the fistula for several days before involving the intra-ocular tissues. If parenteral injections of milk are given at once, the eyeball can be saved in the great majority of cases. Patients must be told of the danger of delay and impressed with the importance of reporting at the first sign of ocular trouble.

DR. A. LOEWENSTEIN, Prague, Czechoslovakia: Fistulizing operations cannot be avoided. In fact, they are preferred by some operators, although in most cases they are not subconjunctival, as desired, but open. A double conjunctival flap is advisable. The flap above and adjacent to the fistula should be denuded of epithelium and a small segment of the cornea pared off, preferably with a Graefe knife, before the eyeball is incised. Even then, an open fistula with all its dangers may develop owing to the remarkable angiolytic property of the aqueous (Elschnig, Festschrift für Fuchs). The vessels over the fistula disappear; the overlying epithelium becomes dull, suggesting Schnabel's cavernous atrophy in glaucoma excavations, and the lytic action of aqueous on iris pigment, which may have a great deal to do with the etiology of glaucoma.

DR. MELANOWSKI, Warsaw, Poland: Two years ago I advised a bridge flap to prevent late infection after the Lagrange operation. It prevents turning over of the flap and consequent contact of the wound surface with the lid margins.

DR. MORAX: A fistulizing scar does not mean a communication of the anterior chamber with the conjunctival sac, but with the subconjunctival space. We can prove this with the fluorescein test or the corneal microscope. Hence we cannot adduce infection after fistulization into the conjunctival sac to prove or explain anything about late infection after a correctly performed operation with broad covering of the scleral defect with a generous conjunctival flap.

LEISHMANIA KERATITIS. DR. C. CHAMS, Teheran, Persia.

Corneal involvement was first described by Lessan-Chams (1923). Nineteen cases have been seen since. The course is like that of a pneumococcus keratitis, but is more acute and intense. We find epithelial erosion or phlyctenular ulcers; later, abscess and perforation. Treatment with neoarsphenamine in the first stage generally results in a cure with vision from 1/4 to 1/20. After the fourth week, perforation takes place in 50 per cent of the cases.

LYSOZYM AND OCULAR INFECTIONS. DR. RIDLEY, London, England.

The discovery, nature and important properties were described, particularly the action on pathogenic micro-organisms in the concentration in which it is usually found in the normal tear secretion of man. Atropine, by checking epiphora, increases the lysozym content of the tears.

PATHOGENESIS OF SYMPATHETIC OPHTHALMIA. DR. MARCHESANI, Munich, Germany.

Repeated inoculations of one eye of a rabbit with *Bacillus subtilis, Bacillus xerosis* or staphylococci result in the development of an allergy and in choroiditis of the untreated eye owing to an antigen action of the albumin (foreign protein) of the bacilli. The transport of products that cause inflammation takes place by the blood. The inflammatory changes in the tissue of the first eye are a result of a primary toxic action of the introduced germs plus an allergy reaction, comparable to a sympathetic ophthalmia with a form of accompanying septic endophthalmitis. The reaction in the second eye is a pure allergic inflammation and is limited to the uvea (demonstration).

EXPERIMENTAL STUDY OF INFECTION, TOXINS AND ANAPHYLAXIS IN SYMPATHETIC OPHTHALMIA. DR. VON SZILY, Münster, Germany.

Check-up tests were made to determine the value of the following investigations: Guillery's on tuberculotoxins, Marchesani's on *Bacillus subtilis,* von Riehm's on anaphylaxis and von Szily's on eye-to-eye infection-inoculation with herpes virus. Not all diseases of an eye after inoculation of the fellow agree with our conceptions of sympathetic ophthalmia.

DISCUSSION

DR. MARCHESANI, Munich, Germany: It has been objected that the process in the second eye in my experiments is simply metastatic. If this were so, it would have to come on after a single infection (? P. H. F.). This is not the case. Repeated inoculations are required. In fifty trials, there was not a single "sympathetic" reaction after the first or second infection, while choroiditis developed in 15 per cent after the third and thereafter. Von Szily's similar observation after blood and orbital infection (they were not identical, as metastases were also found in the retina and nerve) does not prove that the reactions in my experiments were not sympathetic. His experiments with herpes are by no means the "model tests," as he claims, for sympathetic ophthalmia. Intraocular inoculation with herpes causes encephalitis in 50 per cent of the cases. In the positive cases with involvement of the second eye, the percentage is even higher. Sympathetic ophthalmia may be a metastatic process of some sort, but at least in man it is certainly not part of the clinical picture of encephalitis.

DR. S. R. GIFFORD, Chicago: With Lucic I was able to confirm von Szily's experiments and in 10 per cent of the cases to obtain a similar clinical picture and histologic observations. The injection of herpes virus into the chiasm could always produce bilateral optic neuritis. While these results are not decisive for sympathetic ophthalmia in man, they are a model test for the transport of micro-organisms from eye to eye by the optic nerve paths. The anaphylactic theory of sympathetic ophthalmia has not been proved, and a further etiologic factor must be sought.

DR. VON SZILY: Marchesani's view of the rôle of *B. subtilis* in experimental sympathetic ophthalmia is disproved in an important point by the fact that this germ introduced intravenously or into the empty

orbit after enucleation (? P. H. F.) still produces true metastases. There is no essential difference between injection into the eye and into the empty orbit (? P. H. F.), as clinical, histologic and bacteriologic observations are identical.

GAS BUBBLES IN THE ANTERIOR CHAMBER. DR. REIS, Lwow, Poland.

A new clinical diagnostic sign of metastatic endophthalmia due to *Bacillus coli* was observed in a woman, aged 50, who had chronic nephritis and diabetes due to mixed infection of *B. coli* and staphylococci. Iridocyclitis was present, with pupillary occlusion. Metastatic panophthalmitis was suspected. The anterior chamber was very shallow. Between the iris tissue and the cornea several gas bubbles were seen distinctly. The globe had not been injured or operated on, and there had been no procedure to remove material from the anterior chamber. This hitherto unreported phenomenon is to be explained by the entrance of *B. coli* via the blood stream into the interior of the eye, where the organism found a nutrient medium containing sugar and announced its presence by the evolving of gas.

BLASTOMYCOSIS OCULI. DR. S. H. MCKEE, Montreal, Canada.

This article appeared in full in the March issue of the ARCHIVES (**3:** 301, 1930).

ISOLATION OF A FILTRATE VIRUS IN OPHTHALMIA PERIODICA EQUI. DR. A. C. WOODS and DR. CHESNEY, Baltimore.

The virus was kept alive by being passed through rabbits by means of intra-ocular injections which caused exudative retinitis. Reinjection into the eyes of horses reproduced the original eye disease. The pathology was described.

LOCAL IMMUNITY IN OPHTHALMOLOGY. DR. GUYARRO CARRASCO, Madrid, Spain.

The most sharply defined indications in ocular disease are found in the prophylactic and therapeutic use of antivirus in staphylococcus, streptococcus, and pneumococcus infection. This requires morphologic and biologic identification of the micro-organism causing the infection or, in the case of preventive treatment, of the bacterial flora of the conjunctival sac. The local application of antivirus (compresses, wet dressings, irrigation of the lacrimal sac, eye drops) does not interfere with any other form of local or general treatment that one may wish to apply.

ORBITAL ANESTHESIA. DR. LIEBERMANN, Budapest, Hungary.

This procedure has no counterindications. It can be used in all cases in which there is doubt of subconjunctival injection being sufficient. In advancement and in magnet extractions, especially if the eye is much inflamed, a special technic and indications are required for deep orbital anesthesia. We must avoid hematoma, by gradual injection while

introducing a sharp fine needle, adding a 2 per cent solution of a flavine dye to the anesthetic fluid and painting the eyelids with iodine before injection.

HYDATID OF THE ORBIT. DR. PALOMAR DE LA TORRE, Zaragoza, Spain.

Four cases occurred, all in young subjects. There was a gradual development in the course of several months. A positive Weinberg-Cassoni reaction was obtained. Various methods of localization were used. Surgical removal is not technically difficult unless adhesions are present. No relapses occurred.

DISCUSSION

DR. D. V. GIRI, Eastbourne, England: Was there any postoperative diplopia and how was it relieved?

DR. TORRE: Diplopia was generally the symptom that led these patients to consult an oculist, but it had not followed operation in any case.

EXTIRPATION OF ORBITAL CYST-FORMATIONS BY SUBAPONEUROTIC ORBITOTOMY. DR. ROLLET, Lyons, France.

I advise the use of the procedure that I reported at the St. Petersburg Congress in 1914 for the removal of cystic tumors without the aspiration or injection of irritating fluid. Cure was obtained in one case in fourteen days without technical difficulty. No fistula or diplopia developed. A complicating corneal ulcer cleared up promptly.

OPERATIVE REMOVAL OF ORBITAL TUMORS. DR. PAPARCONE, Florence, Italy.

I recommend the transpalpebral method of Scarpa which is applicable in retrobulbar tumors.

REMOVAL OF ORBITAL HERNIAL FAT. DR. BOURGUET, Paris, France.

Projection pictures were presented showing the result of an operation through the lower culdesac.

FIBROMA OF THE ORBIT. DR. GIRI, Eastbourne, England.

A woman, aged 52, had a fibroma of the orbit of fifteen years' duration. Removal through the conjunctival path gave a perfect cosmetic result. Persistent diplopia after the operation and abduction of the right eye were noted in spite of its being kept covered for seven months (! P. H. F.). Operation on the right eye corrected one component of the faulty position, but diplopia persisted (! P. H. F.). The right eye was again occluded for six months (! P. H. F.), after which the diplopia disappeared, but the patient felt sick and weak after using the eyes for an hour. She was advised to use both eyes as much as possible and to close one eye for a short time as soon as ocular fatigue was noticed. All complaints were then relieved until the patient's death, fifteen months later.

ROENTGENOGRAPHY OF THE LACRIMAL SAC. DR. CASTRESANA, Madrid, Spain.

Injections of iodized poppy seed oil 40 per cent show the course, form and caliber of the passages as well as the result of operation.

TECHNIC OF DACRYOCYSTORHINOSTOMY. DR. VIZCAINO, Madrid, Spain.

I advise the crown trephine with a central sliding rod to prevent slipping. There should be inclined boring in order to drill deeply into the nasal process of the superior maxilla. The lacrimal bone must not be cut through anteriorly, as we want a flap that hinges from the front, backward. For this purpose we must remove early the gauze packing from the nasal passages. Then the trephine will find no intranasal resistance to work against, and the mucous membrane by virtue of its elasticity recedes in front of the trephine. Through the opening made by the latter a small dentist's hook can be introduced to remove the small disk of bone. The central pointed rod makes only a small correct puncture in the nasal mucosa. After the sac is detached and the bone trephined, a flap, hinging forward, is cut in the sac. Only two sutures are needed.

RHINOGENIC RETROBULBAR NEURITIS. DR. FEIGENBAUM and DR. SALZBERGER, Jerusalem, Palestine.

DISCUSSION

DR. O. THIES, Dessau, Germany, DR. MEESMANN, Berlin, Germany and DR. HOEFNAGELS, Nymwegen: Multiple sclerosis, toxemias and accessory sinus disease are factors. Roentgen examination is important even in the absence of nasal symptoms. Hyperplasia of the mucous membrane, particularly of the antrum, plays a rôle, without polypoid changes or the production of pus, central color scotoma or an enlarged blind spot as an early suggestive symptom. Excellent results have been secured with early conservative (nonoperative) treatment.

DR. STEINDORFF, Berlin, Germany: I advise early surgical intervention; there are dangers in delay. The accessory sinus should be opened and explored whenever possible.

DR. WEILL, Strassbourg, France: I had forty patients who recovered without operation. There is a progressive form of retrobulbar neuritis, probably the first symptom of multiple sclerosis, which rapidly leads to complete monocular blindness. It is noted generally in young subjects, mostly females, and usually heals (? P. H. F.) without operative intervention. The second, atypical, form may develop at any age, progresses slowly, may affect both sides and is due to sinus disease. Here, operation is advisable.

DR. FEIGENBAUM: The rhinogenic factor is indicated by the epidemic occurrence of retrobulbar neuritis after grip (direct communication through the medullary spaces) and by its frequency in old age when multiple sclerosis is improbable. Roentgen examination must show the thickness of the sinus mucosa. Occasionally, prolonged anemization may be of value. Operation may still be necessary later, and the outlook is favorable if the result of the anemia treatment is good.

OCULAR COMPLICATIONS IN LATENT NASAL DISEASE. DR. FORD, London, England.

Eye symptoms may be the sole complaint. Three cases were observed that showed roentgen rays and nasal washing of doubtful diagnostic value, but bacteriologic examination of the irrigating fluid was positive.

RELAPSING OPTIC NEURITIS IN PREGNANCY. DR. PATRY, Geneva, Switzerland.

A patient, aged 31, had severe disturbance of vision as the only complication in three pregnancies. There was no albuminuria. A high urea content was observed in the blood. After interruption of the pregnancy this condition cleared up, or the condition remained unchanged (? P. H. F.). The disease may be explained (1) by compression due to hypophysis hypertrophy of pregnancy, (2) by slow intoxication of the nerve, due either to the same factor, to endocrine anomaly, or to possible acidosis, or (3) by atrophy following arterial spasm of ovarian or hypophyseal origin.

MECHANISM OF CHIASMAL INJURY IN FRACTURES OF THE BASE OF THE SKULL. DR. COPPEZ, Brussels, Belgium.

1. In a fracture between the frontal and the sphenoid the optic canals are torn asunder with a complete or partial sagittal tear of the chiasm. 2. An anterolateral skull fracture causes depression (infraction) of the outer orbital wall, extending to the sphenoidal fissure and optic canal. There is compression of the orbital contents. Traction is produced by the globe on the nerve which is free in the fractured canal and tears off at the chiasm. 3. Fracture between the sphenoid and the petrous portion, running parallel to the axis of the pyramid, may involve the sella at right angles to the optic nerve and may tear the chiasm by distorsion of bones. Clinical observation and experiments on the cadaver support the theory that secondary injury to the chiasm may be caused by traction of the optic nerve.

MALARIA CURES AND PYRIFERIN INJECTIONS IN ATROPHY OF THE OPTIC NERVE. DR. WOLFF, Berlin, Germany.

No convincing improvement occurred in any cases. Loss of vision was arrested in a few cases, while in others progressive deterioration occurred.

DISCUSSION

DR. LINDNER: Genuine atrophy of the optic nerve seems to have increased of recent years, and statistics appear to show that the old treatment with potassium iodide gave better results. There is danger in malaria treatment in advanced stages. Only many cases and observation for at least two years justify conclusions.

DR. JAENSCH, Breslau, Germany: Thirty-two patients have been treated since 1923 for atrophy of the optic nerve with tabes: nineteen after the method of Swift-Ellis, six with malaria therapy and seven with neoarsphenamine, bismuth and a proprietary nucleoprotein substance (phlogetan) and an albuminous substance obtained from bacteria

(pyrifer). In spite of marked improvement in the neurologic condition and sterilization of the cerebrospinal fluid (Liquorsanierung), the nerve disease did not get better. In only a few cases was it stopped or retarded, while in a number of others it progressed more rapidly. Intracysternal treatment seemed the better form of Swift-Ellis cure.

STEREOPHOTOGRAPHIC STUDY OF RETINITIS PROLIFERANS. DR. BEDELL, Albany, N. Y.

Pictures taken at intervals during eleven months' observation of a man, aged 46, showed the development of vascular membranes, primary loss of continuity of the vessels, blood extravasates, and neoformation of anastomoses in a capillary glomerule on both papillae and around them.

NOGUCHI'S DISEASE. DR. OGUCHI, Nagoya, Japan.

This is a disease with congenital hemeralopia and grayish-white discoloration of the fundus. Exclusion of light for even a few hours causes the retinal color to return to normal, and light sense is increased (Mizuo phenomenon). An increase of cones and a diminution in the number of rods are found, histologically in some places, and the retina here resembles that of day birds. There is a displacement of pigment which forms a separate layer between pigment epithelium and rods and cones, as in the lower animals. This is not, as Scheerer assumes, a postmortem change. Both anomalies are atavistic. In a case of Hirota's, eccentric (peripheral) vision was better than usual, but my curves showed that the function of the cones, in dim light, was lowered.

CYANOSIS OF THE RETINA. DR. MORENO, Madrid, Spain.

Overfilling and dilatation of the retinal vessels occurs without hemorrhage. The fundus shows a bluish tone. A cardiac defect, such as open ductus botalli with hypertrophy of the right ventricle, or polycythemia is the cause. In the first instance, both sets of vessels are involved; in the second, only the veins. In arteriosclerosis we may find retinal, without general, cyanosis. In chronic glaucoma a similar condition is caused by obstruction of the return flow of blood. Treatment is causal, with avoidance of overexertion and correction of ametropia.

ANGIOGLIOMATOSIS OF THE RETINA AND GLIOMA OF THE CORD. DR. JESS, Giessen, Germany.

In this condition, which is known also as von Hippel's disease, there was complete loss of vision in the right eye as a result of complicated cataract. Death occurred after five and one-half years from gliomatosis of the cord. Vision in the left eye was kept at 5/15 by repeated roentgen treatments.

DISCUSSION

DR. LINDAU, Uppsala, Sweden: The term "angiogliomatosis" is unfortunate and possibly misleading. Angiomatous proliferation is the

primary and essential feature. The changes in the spinal medulla are of the nature of syringomyelia and represent a coordinated developmental defect.

Dr. Lundsgaard, Copenhagen, Denmark: In a case of angiomatosis retinae, two brothers of the patient and two daughters of one brother died of tumor of the brain. Histologic examination showed that the patient himself also had a cerebellar angioma which was successfully removed by operation.

A Case of Lindau's Disease (Capillary Angiomatosis Retinae). Dr. Paton, Dr. Williamson-Noble and Dr. Greenfield, London, England.

In a girl, aged 16, vision in the right eye became dim in 1926. A year or so later there was sudden failing of vision in the left eye, followed shortly after by photopsia with attacks of severe frontotemporal headache and nausea. The right fundus showed a large white area with a sharp outline and dilated arteries and veins (where? P. H. F.); below the macula there was a second white patch with a central red spot from which arteries seemed to run, and into which veins disappeared. A similar white patch with a central "comet-like" red spot was seen in the left eye. The disk was not swollen. Suboccipital decompression on the right side, in December, 1927, revealed accumulation of fluid in the subarachnoid space, but no tumor. Then, a marked increase in subretinal hemorrhages and detachment led to secondary glaucoma, requiring enucleation in August, 1928. Sections of the eye (demonstrated) showed typical capillary angioma of the retina. The development of cerebellar symptoms marked the case as one of those first correctly interpreted by Treacher-Collins and accurately analyzed later by von Hippel. The primary anomaly is a capillary angiomatosis; the gliosis is secondary.

DISCUSSION

Dr. Van der Hoeve, Leyden, the Netherlands: Lindau's disease is one of the congenital heredofamilial diseases (of the vessels) which cause tumor formation in the central nervous system and retina, like tuberous sclerosis of Boumeville (glia), and Recklinghausen's neurofibromatosis (glia and vessels). These are all forms of a phakomatosis.

Dr. Lindau, Uppsala, Sweden: The clinical diagnosis of angiomatosis of the central nervous system is possible and is greatly aided by the ophthalmoscopic observations.

Significance of Changes in the Reflex from Internal Limiting Membrane of the Retina in General Pathologic Conditions. Dr. L. Pavia, Buenos Aires, Argentine.

Positive results were obtained in a check-up of Vogt's observations with the Gullstrand ophthalmoscope and the Nordensen camera under bright illumination.

REPRODUCTION OF THE CORNEAL SURFACE IN A REFLEX IMAGE. DR. FISCHER, Leipsic, Germany.

Photographs reveal that almost all superficial as well as deep ocular diseases show early and for a long time a characteristic reflex image of the cornea. Reflexography has an epidemiologic significance in the early recognition of smallpox and vaccine epitheliosis and in studies of the influence of section of the trigeminus on the eye.

CHARACTERISTIC PUPILLARY PHENOMENA AFTER LESION OF PERIPHERAL CILIARY NERVE CENTER. DR. DUPUY-DUTEMPS, Paris, France.

The iris does not atrophy or show any alteration in form or function in peripheral or central oculomotor palsy or paresis, while any lesion of the peripheral ciliary ganglion and of the ciliary nerves is always followed by atrophic changes, an irregular pupil, unequal contraction of different iris sectors, loss of response to pupillomotor alkaloids and physiologic stimuli and irregular atrophy (described by me in 1905). Argyll-Robertson pupil is so uniform an occurrence that one gets the impression that this phenomenon must depend on a peripheral nerve, rather than a central, lesion.

ETIOLOGY OF ARACHNODACTYLIA. DR. ORMOND, London, England.

Thirty cases of "spider fingers" have been reported, with eye symptoms in about 50 per cent. The general symptoms, as shown in three cases studied, are long slender limbs with under-developed bones and muscles (mesoblastic abiotrophy), long hands and feet, spindly fingers and toes, and complete absence of subcutaneous fat. Ocular anomalies are ectopia lentis and myopia. The changes are of a regressive nature and possibly due to the action, in utero, of chemical factors which may be regarded as precursors of the endocrine system. This type of infantalism reminds one of the frequency of ocular abiotrophies in cretinism, Mongolian idiocy and anomalies of thyroid and parathyroid secretion, with a presumably similar etiology.

DISCUSSION

DR. STEINDORFF, Berlin, Germany: I saw a case in a girl, aged 7, whose grandfather had strikingly large hands and feet. She had normal intelligence. Bilateral subluxation of the lens was present. Roentgenograms showed excessive growth of the long bones, especially of the distal portions of the extremities, with decreased breadth. There was spinal curvature. Thickening of the facial skeleton was observed, with sclerosis of the bones of the base of the skull. A hollow-eyed appearance was due to the abnormal breadth of the orbit (obliquity, forward and upward, of the floor of the anterior fossa).

DIAGNOSIS AND TREATMENT OF SUPRASELLAR TUMORS: SYMPOSIUM

THE CHIASMAL SYNDROME. DR. HARVEY CUSHING, Boston.

This article appeared in full in the May and June issues of the ARCHIVES **3**: 505 and 704, 1930).

SUPRASELLAR TUMORS. DR. HOLMES GORDON, London, England.

Endothelioma (meningeal fibroblastoma) arising from the periphery of the diaphragma sellae or from the meninges above the tuberculum (Cushing) involves the optic nerve first, and the chiasm later. Loss of vision in the fellow eye may be delayed for a long time. Visual symptoms are: (1) contraction of the temporal fields to an irregular bitemporal hemianopia, and (2) early development of central or paracentral scotoma followed by loss of vision in the temporal field. In both cases, the blindness tends to include the fixation point and to extend rapidly into the nasal field. Primary (descending) atrophy of the optic nerve often does not appear until quite a while after the loss of vision. Papilledema is not observed. Endothelioma is differentiated from adenoma and "stalk tumors" by its occurrence in middle age, the infrequency of later development of increased intracranial pressure, the lack of endocrine anomalies and a normal sella, as shown by roentgenograms. A suprasellar shadow is unusual. Basal aneurysm may cause pressure symptoms from the visual paths, but it rarely interferes with vision until there is rupture or hemorrhage followed by bilateral blindness, partial or complete. Oculomotor paralysis is unusual. Chronic basal arachnoiditis with thickening of the delicate membranes about the chiasm and formation of meningeal cysts is probably associated with chronic circumscribed spinal meningitis following injury or subacute inflammation. Vision is affected in various ways. Primary atrophy of the optic nerve is seen. The sella is normal. No endocrine disturbances are observed. This form, too, is seen commonly in middle age. Vision may improve after operation.

SUPRASELLAR TUMORS ESPECIALLY OF RATHKE'S POUCH. DR. VAN BOGAERT, Brussels, Belgium.

Progressive amaurosis with or without evident optic neuritis may be the only symptom for some time. Choked disk may precede or follow the amaurosis. Tumors of Rathke's pouch may press on the infundibulum and tuber cinereum and produce "dystrophic" symptoms, such as drowsiness, polyuria, disturbance of salt and fat carbohydrate metabolism, vasomotor imbalance, irregular respiration, pigment changes, altered basal metabolism and psychic alteration. In this phase, the tumors reach the limit of operability. Roentgen plates and ventriculography are valuable diagnostic aids.

ENDONASAL OPERATION AND TREATMENT FOR HYPOPHYSEAL TUMORS. DR. O. HIRSCH, Vienna, Austria.

My method, described twenty years before the present congress, consists in raising the mucous membrane of both sides of the septum by an incision through the perichondrium and removal of enough bony and cartilaginous septum to allow opening the sphenoid. This usually exposes the sella enlarged by the tumor. The wall of the sella is chiseled open, the dura incised and the tumor spooned out with eventual resection of the anterior wall in case of a cystic growth. For a successful operation, only those tumors are accessible which grow mainly toward the sphenoid sinus and somewhat toward the base of the brain, as well as all cystic formations. Those which have grown deep into the base

of the brain are inoperable by any method. Since 1919, 103 operations have been performed. The mortality was 5 per cent. Twenty-nine patients remained well over four years after treatment with radium.

CLINICAL COMPLICATIONS OF SUPRASELLAR TUMORS. DR. ROLLET, Lyons, France.

The study of five cases showed: (1) sensory disturbances with compression of the fibers of the optic nerve, and a small growth, relatively benign, and (2) a sensorimotor and vascular form with no compression of the optic nerve. Pressure on nerves along the outer wall of the cavernous sinus (Foix's syndrome) and on the ophthalmic vein caused exophthalmos. There are combined, atypical and borderline cases.

DISCUSSION

DR. IGERSHEIMER, Frankfurt, Germany: Exact and delicate tests of form and color fields and central scotometry are of great diagnostic importance, as are Bjerrum tests with small, colored test objects on a tangent screen or on my large disk for the detection of hemianopic defects. Slight, atypical field defects are common, although Walker and Cushing claim to have noted, more often, surprisingly slight anatomic changes in spite of marked visual field defects. Diagnostically difficult are, of course, those cases in which blindness has progressed to a point where it is impossible to take the fields accurately. A characteristic hemianopic pupillary paralysis can still be elicited in these cases. The combination of atrophy of the optic nerve and marked anemia is almost pathognomonic for suprasellar tumors with predominant extension forward.

DR. L. MUSKERS, Amsterdam, the Netherlands: As soon as the wall of the third ventricle and the thalamus opticus are involved in the tumor process, injury of these parts causes vestibular symptoms and paralysis of associated eye movements. Even involvement of the hypothalamus may cause labyrinthine symptoms.

DR. BROUWER, Amsterdam, the Netherlands: The initial symptoms are important in differentiating between intrasellar and suprasellar tumors. Upper quadrant defect, progressing downward, is noted early in hypophyseal tumors, corresponding to the location of optic nerve fibers for the upper part of the retina in the dorsal aspect of the chiasm. The lower portion of the retina is, accordingly, involved early in swelling of the hypophysis. Extrasellar tumors are accompanied by atypical changes in the field varying with the location and extension of the growth.

DISTURBANCE OF COLOR PERCEPTION. DR. BOREL, Neufchatel, France.

A slight disturbance of color perception, suggesting incipient bilateral homonymous hemianopia, was an early symptom in a case observed. Definite hemiachromatopsia was not established until four years later. Death occurred twelve years later, due to suprahypophyseal glioma. One must be careful in the diagnosis of neurasthenic eye symptoms, and give heed to slight color changes and the subjective field defects of intelligent patients, which are often most suggestive.

RETINAL DETACHMENT

DIFFERENTIATION OF SENILE AND OF MYOPIC DETACHMENT. DR. KAPUCZINSKI, Posen, Poland.

There are contrasts in the function of detached retina, in its location and that of tears and in prognosis. A specimen showed cystic degeneration of the retina as a primary factor, as cysts do not develop as a result of traction by vitreous proliferations.

SURGICAL TREATMENT FOR DETACHMENT. DR. FIORE, Rome, Italy.

After localization of partial separation, an incision was made with a white-hot sickle-shaped Paquelin cautery meridionally into the subretinal fluid accumulation, causing reattachment.

DISCUSSION

DR. J. GONIN, Lausanne, Switzerland: There is no essential difference between senile and myopic detachment, as both factors are often present in the same patient. A rapid survey of 125 cases showed senility without myopia in fourteen and myopia (above 4 diopters) without senility in twenty-one. In these two categories there was no contrast in clinical symptoms or fundus observations, as claimed by Kapuczinsky. Fifteen juvenile cases without myopia, however, did show peculiarities, as nine presented a detachment of the retina from the ora serrata. Retinal cysts may be independent of the vitreous, but proliferations of that body act in some cases as a predisposing factor.

TREATMENT FOR DETACHMENT. DR. ARRUGA, Barcelona, Spain.

An abstract of this paper appeared in the March issue of the ARCHIVES (3: 356, 1930).

DISCUSSION

DR. J. GONIN, Lausanne, Switzerland: I am gratified to find my operative methods and results confirmed by Arruga and Vogt. The success of obliterating thermocauterization furthermore proves the accuracy of Vogt's views as to the pathogenesis of detachment. Further cooperation in clinical study is welcomed.

LOCAL TREATMENT FOR DETACHMENT. DR. J. GONIN, Lausanne, Switzerland.

Failure in so-called spontaneous detachment is generally due to ignorance of the causal factors, the most important of which is tearing of the retinal tissue by pull from the vitreous. Sourdille and others consider these tears of minor importance, while some surgeons think that they make the prognosis hopeless or that they even counterindicate operation (Holth, W. Lister). Both opinions are mistaken, as it is the finding of a tear and its obliteration by cautery that enables one to get rapid healing; but the operation must be carried out within a few days if possible, or at least within a week or two after detachment has taken place, and must be delayed only by the absolutely necessary technical preparations.

DISCUSSION

DR. PINCUS, Cologne, Germany: A man, aged 40, had vision of 6/6—, and flat detachment above the macula. Annoying photopsiae and subjective symptoms had been present for one year. The other eye was completely blind; detachment had occurred twenty years before. The field showed a slight contraction below for white and more decidedly for blue. No tear was found by Professor Cords or me. The case was referred to Dr. Gonin, who found a minute tear (demonstrated); he obliterated it at the first attempt with the cautery and healed the detachment, with complete recovery. This was an acid test. It takes courage, conviction of the value of one's own method and admirable technical precision to carry the glowing cautery into the one remaining eye with good vision in which a tear was unfavorably located. Accurate localization is the sine qua non if this promising procedure is to become common property not only of one or two masters but of every trained ophthalmologist.

DR. LINDNER, Vienna, Austria: I have had twenty-two cases since the fall of 1928. Tears were found in fourteen patients and operated on. There were two cases of hole in the macula and in one with very large tear cauterizing was not done. Seven patients in whom cure was obtained were observed for as long as ten months. Of the last seven, there was reattachment in five, all of whom had shown peripheral tear which is prognostically the most favorable site. Localization is as follows: The patient faces the Gullstrand apparatus, fixing a movable light target on a perimeter arc. The macula is brought into the middle of the field. The patient's eye then follows the target until the retinal tear appears at the center of the picture. The angle of the nodal point between the line of fixation and the direction line of the tear with the axis of the meridian is noted by the arc reading. A table gives the direct value of the distance of the tear from the limbus. The scleral point having been determined, a small indicator is sutured directly to it, and at its point the red-hot electrocautery is applied and allowed to remain in the vitreous for ten to twenty seconds. If preferred, the sclera may be opened with a 1 mm. trephine instead of with the actual cautery point.

DR. IGERSHEIMER, Frankfurt, Germany: In a week spent with Gonin I learned the importance of carrying out his procedure scrupulously and of following his technic in finding and closing the tear. The dangers are: incorrect localization or faulty application of the cautery point; a tear too large to be closed, and the occurrence or presence of more than one tear. In one case a cure was obtained in spite of the tear being much larger than the area of cauterization. In another, the condition became worse after cauterization of a tear. After a second tear had been found, however, cauterization which at first produced an intense reaction from burn, extending far beyond the area of the tear, brought about an almost complete reattachment. The actual operation is simple, except when the tear is very far back or inaccessible, but preparation and localization require patience, accuracy and skill. In one case it was necessary to detach, temporarily, the superior and inferior rectus in order to reach the tear which was only 5 prism diopters from the disk. This was on the nasal side, but the eye stood this well. In cases of long standing, operation is advisable as long as the retina shows function, or

if there is a progressive loss of vision. Very young children do not act well and will not lie quiet for five or six days. In very old patients, on the other hand, there is always danger of hypostatic pneumonia if they are kept flat on the back for so long. Gonin's operation is a remarkable step forward, but detachment of the retina is still a most serious condition.

Dr. A. Loewenstein, Prague, Czechoslovakia: I recant my disbelief in the significance of retinal tear and I wish to praise Gonin's obliteration cauterization as an actual experimental demonstration of the curative effect of closure. Still, one must not overlook other factors, notably hypotony, in the causation and progress of detachment. I combine Gonin's operation with the "colmatage" of Lagrange, salt-free diet and tuberculin, with satisfactory results. I should like to ask Dr. Gonin whether it is necessary to hit the tear exactly with the cautery or whether it is sufficient, as Vogt claims, to apply the cautery fairly near it. My data speak for both views. Relapse, due to overexertion, may follow cure by cauterization, and a second obliteration results in permanent cure with good vision. The reattached retina may show relative or absolute color scotoma, the intensity of which does not seem to correspond to the form or age of the detachment.

Dr. Weill, Strassbourg, France, and Dr. Bruckner, Prague, Czechoslovakia: Mention was made of the technical difficulty of detection, localization and exact touching of the tear with the cautery, and the danger of hypostatic pneumonia after operation.

Dr. Pascheff: There are cases without tear and with spontaneous reattachment. Only the study of each individual case, clinically, can result in a correct decision.

Dr. F. Salzer, Munich, Germany: Tests of regional light sense and possibly of color sense of the retina are important in the diagnosis of the site and extent of the tear.

Dr. Deutschmann, Sr., Hamburg, Germany (reported by Dr. Peltesohn): As long ago as 1904, I used galvanocautery puncture of a large detachment with a tear near the equator. Spontaneous tear leads to reattachment only if it is closed spontaneously or by operation. Later, this form of treatment was given up on account of the danger of late scar contraction and even more extensive secondary detachment as a result. Tear is not requisite, as claimed by Vogt, for detachment, even in half the cases. The credit for first suggesting ignipuncture to close the tear in detachment belongs to me and not to Gonin.

Dr. Kapuczinsky, Posen, Poland: I distinguish between retinal tears and holes, as the latter may occur in a retina that is already detached. That is why it is sometimes impossible to find a tear or hole, on early examination of the fundus. It develops later. The differential points that I noted between senile and myopic detachment, disputed by Gonin, are seen only in the early stages of the disease, and the clinical picture is the same for both groups later.

Dr. Gonin: It is amazing that some oculists still cannot see that actually closing the tear at the beginning of a detachment is sufficient to bring about complete reattachment. Two theoretical objections have been raised: 1. It is illogical to operate on a hypotonic eye by injuring the

sclera when hypotony is so often accompanied by detachment. Here cause and effect are confounded. After closure of the operative wound, the surgical procedure diminishes or entirely neutralizes hypotony. 2. Dr. Poyales thinks it improbable that the reattached retina is fully restored to its relations with the adjacent tissues. He is right, but practical experience teaches that extensive restoration of function is possible, unless the case has been allowed to go too long. Often enough, color and light sense remain below par, but in fresh cases the final function is satisfactory.

CATARACT OPERATIONS: SYMPOSIUM

INTRACAPSULAR EXTRACTION OF COMPLICATED CATARACT. DR. STOCK, Tübingen, Germany.

Fifty-two cases were studied, mostly of chronic iridocyclitis, with lens changes and complications such as glaucoma or detachment. The procedure used included a large linear incision, a broad iridectomy, preparatory or at operation, and delivery of the lens by a sliding (Schlitten) maneuver without the previous breaking down of synechiae; extraction was performed with a wire loop, if necessary. Improvement of vision occurred in fourteen cases. I agree with Axenfeld that this procedure is the only means of giving useful vision to patients with complicated cataract in chronic iridocyclitis, as opening of the capsule is almost always followed by failure.

CORNEAL SUTURE WITH INTRACAPSULAR EXTRACTION. DR. E. KALT, Paris, France.

Experience has shown the importance of removing, besides the contents of the capsule, the membrane and particularly its epithelium, to prevent the development of after-cataract. Extraction of a piece of capsule is often followed by the escape of the entire lens. It is a delicate and dangerous procedure.

KERATOME INCISION IN SENILE CATARACT. DR. WEILL, Strassbourg, France.

Since the earliest days of cataract extraction the advantages of a linear section have been generally admitted and attempts have been made to use this procedure, but it was always found impossible to make an incision large enough to give exit to the lens. I find that this difficulty can easily be overcome and the incision enlarged by lateral motion of the keratome as it is withdrawn from the anterior chamber.

LATERAL INTRACAPSULAR EXTRACTION. DR. VAN LINT, Brussels, Belgium.

An ideal and safe procedure consists of the following steps: a conjunctival flap on the temporal side; sutures are passed; a keratome incision is made in the lateral side of the cornea, and enlarged with scissors; the lens is grasped by suction, turned and extracted; the wound is closed, and preliminary sutures are tied.

PRESENT STATUS OF INTRACAPSULAR EXTRACTION. DR. ELSCHNIG, Prague, Czechoslovakia.

Statistics show a diminution in the percentage of vitreous loss, infection, and prolapse of the iris in the last 246 operations, due in part to retrobulbar anesthesia and preliminary conjunctival flap suture. Extraction according to Stanculeanu, Knapp and Török is the operation of choice.

IRIDOTOMY IN CATARACT EXTRACTION. DR. CUELLAR, Havana, Cuba.

The purpose is to effect a permanent communication between the anterior and the posterior chamber, and the procedure is of great value in preventing postoperative iritic complications, synechia or differences of tension, while it improves ocular nutrition and so lessens the incidence and danger of postoperative infection. This procedure takes the place of peripheral iridectomy (Pflueger-Hess) or sphincterectomy, which abolishes the normal contraction of the pupil. This "central iridectomy" is used after intracapsular, as well as ordinary, extractions.

CATARACT OPERATIONS. DR. SINCLAIR, Edinburgh, Scotland.

Dr. Sinclair presents clinical experiences, some technical and instrumental modifications, and remarks on 100 cases (film).

DISCUSSION

DR. BARRAQUER, Barcelona, Spain: Extraction of the lens with capsule forceps is an old procedure, as noted by Marquez. It was given up, as traction on the zonule caused injury of the ciliary body and resulted in complications. On the other hand, expression by the method of Smith endangers the vitreous. The "erysiphak," however, quickly tears the zonule free at its lenticular attachment without traction on the ciliary body. I now extract with my apparatus after lid-block, with peripheral iridectomy after section and conjunctival suture (film). This Spanish method gave better results than any other in 4,700 cases.

DR. LOTHAR MEYER, Dresden, Germany: I have used the lance knife (Weill) almost exclusively since 1913 and find it quite sufficient (13 mm. base, Fischer-Freiburg). With slight twisting in the plane of the iris, the section is ample and can always be enlarged with scissors. The main difficulty was the inability to get a sufficiently broad conjunctival flap. This is effected now by putting the conjunctiva on the stretch (Perlmann) with forceps at fixation and by cutting through it with the keratome 5 mm. from the limbus. It is then incised, laterally, at both ends with two strokes of the scissors. Simple extraction is generally feasible, although it should be performed more slowly than after section with the Graefe knife. Removal of cortical masses is done with a spoon (Hess). Reposition of the iris, and particularly the smoothing out of the iris root, crumpled or folded toward the limbus during expression, is done by stroking at right angles through the sclera. Then peripheral iridectomy is usually performed. The keratome incision heals quickly; only one eye "vault" is opened, i.e., the corneal, and not the scleral vault, too; hence there is less astigmatism and better visual results.

These advantages over the flap incision are not offset by any complications.

Dr. de Sanès-Martin, Toulouse, France: I have performed total extraction since 1921. It is the operation of the future and gives the best results. The subconjunctival injection of epinephrine, one hour before, lasts throughout the operation, allowing a large piece of the capsule to be grasped and overcoming the resistance of the sphincter. The percentage of successfully extracted lenses is increased. Lid-block, corneal suture, peripheral iridectomy and the instillation of physostigmine after operation, to prevent prolapse of the iris and vitreous, are essential details of this procedure.

Dr. J. Imre, Pecs, Hungary: I have used the Kalt forceps since 1918 with excellent results. I successfully removed 50 per cent in the capsule (Knapp) including dislocated, milky and swollen cataracts. The average vision was 6/12. "Bridle" suture (Blaskovics-Elschnig) was employed as a routine measure. No retrobulbar injections, no lid-block and no conjunctival or corneal sutures were used. Enlargement of the corneal section with scissors should be avoided.

Dr. Lindner, Vienna, Austria: I favor lid-block, as it prevents complications. No retrobulbar injection should be made, as a soft eye makes it very difficult to massage out remnant lens masses in case the capsule bursts. Complete removal of the intact lens was possible in only one third of the cases. If the capsule tears late it is often possible to turn back the corneal flap with forceps and to grasp and remove the capsule tags. Healing without irritation results in a very slow restoration of the anterior chamber; hence, the double importance of suture. Iridotomy leads later to prolapse of the iris in many cases, as the hole is not large enough. I have gone back to peripheral iridectomy at the close of the operation.

Dr. Marquez, Madrid, Spain: Extraction in the capsule is the oldest procedure known for cataract, and is well depicted in the "Cours d'opération des yeux" (Montpellier, 1789).

Dr. Botteri, Zagreb, Yugoslavia: Since 1901, I have used Kalt's corneal suture with good results, but only when loss of vitreous is apprehended, as in extraction of a lens dislocated into the anterior chamber, in cataracta tremula, etc. In all other cases, the results, especially as to postoperative astigmatism and healing or reopening of the corneal wound, are just as good without it.

Dr. Pischel, San Francisco: I again advise, as I did several years ago, rat-tail tendon for suture material, as it is fine and strong and absorbs in about a week, while silk and female hair (Japanese) recommended by some ophthalmologists have to be removed subsequently, and catgut and kangaroo tendon are too coarse.

Dr. Hildesheimer, Berlin, Germany: I find it necessary to enlarge the keratome incision into the sclera, right and left, with small curved scissors. Extraction, especially of a complicated cataract, is difficult, as we have not yet an ideal form of lance. It is not necessary to stretch the conjunctiva with forceps. A broad flap can be made by applying the point of the keratome further back and pushing a fold of conjunctiva in front of it until it is cut through. Before extraction, the point of introduction (puncture) of the Graefe knife should be touched with

iodine as this is the only point which comes in contact with the conjunctival fluid from the outside (? P. H. F.). If intracapsular extraction fails, it would seem advisable to attempt removal with the wire loop rather than to resort to extracapsular extraction. Visual results are excellent. Perhaps many cases of insidious iridocyclitis have been due to some hitherto unknown toxic action of retained lens albumin.

Dr. V. Lussitch-Matkovich, Zagreb, Yugoslavia: Rapid healing is promoted by allowing the patients to go about instead of keeping them in bed. In trachomatous eyes no bandages are to be used and even in arteriosclerotic and debilitated patients, a simple eye dressing is sufficient if it is hermetically sealed by being fastened to the brow and cheek.

Dr. Aubaret, Marseilles, France: It is nearly 200 years since Daviel devised the procedure of extraction and later (1756) described the first straight cataract knife (couteau de la Faye) when Beranger of Bordeaux designed the first keratome. Section with this instrument has the advantage of going uniformly from without inward so that tension (tonus) remains normal until the section is completed, and healing takes place rapidly and smoothly. One lance does not make a sufficiently large section, so I use two with good results.

Dr. M. Sobhy, Cairo, Egypt: In seventy-five cases I used Barraquer's operation. There was no instance of hemorrhage from the ciliary body into the vitreous (Kalt). Hyphemia may be noted, but the blood never gets into the vitreous. Discission, made necessary in these cases, is less difficult than with the classic method. Two sutures close the lids after operation to prevent "lagophthalmos from lid-block" (! P. H. F.).

Dr. C. Pascheff, Sofia, Bulgaria: On the basis of 8,000 extractions, I advise suture fixation of the superior rectus; corneal section with a conjunctival bridge, taking in the entire upper semicircumference; removal of a portion of the capsule and extraction. In case of difficult delivery of lens, I advise "total" iridectomy and fixation of the lens nucleus with a small hook applied to the surface of the nucleus, or, in case of dislocation, to the posterior pole of the lens. Intracapsular extraction should be performed in a case of tough capsule. The lens-shover (Linsenschieber) is then very useful. Intra-ocular iridotomy, as peripheral as possible, should be performed after extraction.

Stereoscopic Treatment for Heterophoria. Dr. D. W. Wells, Boston.

I use a stereoscope consisting of 2 spheres + 10 diopter lenses in the phoroptometer frame. Rotating prisms are adjusted so that the visual lines of both eyes, at the distance (10 cm.) of the test cards, are 6 cm. apart. Decentration, each millimeter corresponding to 1 degree prism, is performed during fusion effort. This forcing of prismatic action on the patient allows excessive convergence or divergence, and as the fusion image is the point of fixation, breadth of convergence and of fusion are identical. Prisms are gradually strengthened; a hand stereoscope with suitable cards is used at home, and the patient reads and writes with a control bar which makes it obligatory to use both eyes in reading each row (line? P. H. F.). Generally, a dozen treatments at increasing

intervals for one to two months are enough. Cure or decided improvement occurs in from 85 to 90 per cent.

INTERNATIONAL STANDARDS OF VISION. DR. CHOLINA, Kiev, Russia.

For the hygienic campaign on children's eyes the "ophthalmopaedologist" needs data on constitutional and environmental visual factors and their reciprocal relations. The usual optotypes give an atypical series of variations due to errors in method. A new geometric-progressive set of tests is presented, with intervals of 24.10, indicating from 0.1 to 2 vision, with international figures and improvements by Zikulenku. These give a "typical" series of variations showing that the test types are constructed on correct optical principles.

SYMMETRICAL LYMPHATIC HYPERTROPHY OF THE CONJUNCTIVA AND LYMPHOMAS OF THE SKIN. DR. PASCHEFF, Sofia, Bulgaria.

In the case observed, no leukemia was present; there was merely lymphocytosis.

A CASE OF PYKNOLEPSY. DR. PASCHEFF, Sofia, Bulgaria.

Upward deviation of the eyes and complete loss of consciousness occurred. The "ocular crisis" lasted for several seconds and was repeated several times daily. Occasional convergent squint was observed in the left eye. The ocular symptoms began two years before, with epileptic attacks which soon disappeared.

NEW YORK ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY

W. F. C. STEINBUGLER, M.D., *Secretary*

March 17, 1930

ERNEST F. KRUG, M.D., *Chairman*

A PRELIMINARY REPORT OF A CASE OF METASTATIC CARCINOMA OF THE CHOROID AND OPTIC NERVE. DR. CLYDE E. MCDANNALD AND DR. B. F. PAYNE.

The preliminary case report presented was that of an Italian woman, aged 42, who was brought to the clinic at the New York Eye and Ear Infirmary by a member of the house staff, Dr. Payne. The following history was obtained. On March 1, 1928, a radical right mastectomy was performed at the Roosevelt Hospital. The pathologic report returned was "Carcinoma of the female breast with metastases of the axillary lymph nodes, group 3." On Jan. 9, 1929, she was readmitted with a diagnosis of metastatic carcinoma in both lungs. This condition was treated with the roentgen rays.

On December 18 she came under our observation, complaining of pain in the right eye and the right side of the forehead, with drooping

of the upper lid and blindness. Blurred vision was noted eight months previously, which gradually progressed for six months when the eye became totally amaurotic. During this time the pain was relentless, at moments being excruciating, and was uninfluenced by drugs. Ptosis had existed for only three weeks.

Examination showed a complete paralysis of the right third and fourth nerves, the eye deviating out and up. The sixth nerve was not involved. There was no proptosis or increase in tension. The lacrimal apparatus, the conjunctiva, the cornea and the anterior chamber were normal. The pupil was widely dilated. The media were clear.

The lesion was confined to the disk and immediate surroundings. It was grayish and slightly elevated, with complete obliteration of the vascular funnel. The margins were blurred with an infiltration extending about 3 disk diameters nasally. Small blood vessels wound in and out in the infiltrated area, but there were no hemorrhages and no edema; neither could retinal detachment be made out. The larger arteries and veins appeared to be perfectly normal. The eye was totally blind without consensual reaction.

The left eye was normal with 20/20 vision.

A diagnosis of metastatic carcinoma of the optic nerve was made and removal of the eye advised. After some persuasion, the patient consented to the operation, hoping to be rid of her pain.

The enucleation was performed on December 20, an attempt being made to cut the nerve as long as possible. Two days later the pain ceased. On December 29, a heavy dose of radium was given. This burned the lower lid and caused slight sloughing, which healed slowly and gave the patient some annoyance.

The growth was considered to be primarily in the optic nerve, for the following reasons: 1. There was total blindness. 2. Definite invasion of the nerve head could be seen with the ophthalmoscope. 3. With the exception of the disk and the contiguous area, the fundus was normal. 4. Severe pains without signs of irritation in the eye suggested an intracranial involvement with extension into the nerve and its sheath. 5. In the surmise of intracranial metastases, paralysis of the third and fourth nerves was taken into consideration.

DISCUSSION

DR. BERNARD SAMUELS: Sections of the eye showed an increase in thickness of the optic nerve. There was a new growth in the choroid on the temporal side, continuous with the growth in the nerve. The tumor was almost flat, as are most metastatic carcinomas. I regard the case as a primary metastasis in the choroid, which grew and involved the optic nerve.

A CASE OF CONTUSION OF THE EYEBALL WITH MARKED CHANGES IN THE VITREOUS AND FUNDUS. DR. RAYMOND E. MEEK.

D. M., aged 22, came to Dr. Webb W. Week's clinic at the New York Eye and Ear Infirmary complaining of a severe pain in and about the right eye, with the history of having been struck in the eye with a fist five years previously, since which time there had been no sight. There was light perception in the right eye, and the vision in the left eye

was 20/30. The tension in both eyes was equal and soft. Externally, the eyes were normal, with an exotropia of 20 degrees in the right eye for distance and 15 degrees for near. The right eye turned up slightly in abduction, probably due to a spasm of the right superior rectus. It did not react to direct light but did react consensually. Ophthalmoscopic examination showed a clear lens with the exception of a few small deposits on the posterior capsule. There were some floating vitreous opacities. In about the middle of the vitreous was a rather large opening in what might have been exudate or an organized hemorrhage. Vessels could be seen through this hole in the back of the eye. There was pigmentation of what was probably an old choroiditis on the temporal side of the eye. There were some crystalloid bodies below. The Mantoux and Wassermann tests gave negative results.

DISCUSSION

DR. SIGMUND A. AGATSTON: After the injury was there a great deal of hemorrhage?

DR. RAYMOND E. MEEK: The injury was due to a severe blow in the eye with the fist; I do not know whether there was hemorrhage, but probably there must have been.

DR. SIGMUND A. AGATSTON: It seems evident that whatever the lesion is, it is caused by trauma, and Coat's disease is rather doubtful in this case. From the appearance of the fundus, I hardly think that it is Coat's disease. There is no limit to the appearance of the fundus after an injury. After an injury there is apt to be a traumatic choroiditis. In this case, the injury has caused a great deal of hemorrhage into the vitreous, which is hazy and degenerated, and I think that this might be called a traumatic choroiditis.

THE GONIN OPERATION FOR DETACHMENTS OF THE RETINA. DR. MARK J. SCHOENBERG.

This article appeared in full in the June issue of the ARCHIVES (3: 684, 1930).

DISCUSSION

DR. ARNOLD KNAPP: The Elliott trephine operation and the Lagrange operation made such a great improvement in our results in chronic glaucoma that our interest in this disease was tremendously stimulated, and this led to the refinement of our methods of examination, particularly of the field of vision and of the light sense. We are going through a similar experience with detachment of the retina. The remarkable results that Gonin has obtained by ignipuncture in retinal detachment will lead to a renewed interest and study of the whole subject of retinal detachment. Aside from the introduction of his method of operating, I think that he deserves great credit in having demonstrated the importance of the tear in detachment of the retina. He has shown that the holes are usually situated in a certain part of the retina. There may be a number of holes, and they may be of various shapes. We also know that there are cases (I have one definitely in mind) in which a hole has existed in the retina without a resulting detachment. One of the cases reported by Dr. Schoenberg demonstrated a curious V-shaped tear six months before the detachment

developed. There are cases in which the patients have been spontaneously cured, and in which the holes were noted to have contracted, and in some cases could no longer be identified.

My experience with this operation is limited to five cases in which I would like to acknowledge the enthusiastic and ever-ready cooperation of Dr. Schoenberg. The two successful cases have been enumerated in Dr. Schoenberg's list. The three cases which are failures are cases in which the retina was torn away at the periphery of the fundus, leaving a large crescentic gap in which the choroid was visible. In one of these cases, after ignipuncture, the retina became frayed, like the old flags in the Memorial Day parade. The second case was one in which, though we struck the right spot, the ignipuncture was apparently not deep enough, and the retina did not become adherent. In the third case, there followed a subretinal hemorrhage, and some hemorrhage in the vitreous, with blood deposit on the posterior surface of the lens, so that the fundus was not clearly recognizable. To my mind, in ignipuncture we cause a coagulum of the albumin of the subretinal fluid, which apparently organizes, contracts and attaches the retina to the underlying choroid. The question naturally arises, is it not dangerous to cauterize the retina itself? It seems to me that in the case in which we had the torn flaglike effect, this was the result of a necrosing influence on the retina. I should also like to ask Dr. Schoenberg what his experience has been with hemorrhage, and, finally, does the lens ever suffer from the heat of the cautery?

Dr. Edgar S. Thomson: Whatever may be our idea as to the pathology of retinal detachment, there will be, I think, no one to dispute the assertion that those cases with retinal tears are the most intractible with which we have to deal. It is not definitely known how tears come on. Some investigators think that they occur at the time the detachment occurs, and that the frequency of the "arrow head" shape indicates that the lower part of the point has adhered to the underlying choroid, or rather to the tapetum nigrum, while the retina beyond the point is torn off. I do not believe this view to be correct always, as other shaped tears occur, and, moreover, I have seen a detached retina grow thinner and finally give way. It is certain that many tears occur early and exist when we first see the case. There seems to be a free interchange between the vitreous body and the subretinal space of lymphatic fluid passing through the tear, and attempts to remove the subretinal fluid are about as successful as would be the attempt to bail out a boat with a hole in the bottom. In some of our cases of reattachment we have secured good vision after six months, so that it is evident that the retina does not degenerate as fast as we have thought.

Another question concerns the predominance of the tears. My experience has been that they occur in about one third of the cases. I am fully aware that there are many cases in which the tears are hard to see and difficult to diagnose. I do not believe that tears have been present in any of our successful results.

Another question that occurs to me is, if this cautery produces inflammation, why is the treatment not just as good in detachments without tears?

In our series of cases of trephine and aspiration, we have had about twelve total reattachments that persisted as long as the patients were

under observation—in some cases, from five to ten years. Partial reattachments are of no permanent value, as the retina degenerates and shrinks, and the detachment increases, even if it is a small one. I have never seen the slightest attempt to adhere on the part of a retina with a rent, even after all the subretinal fluid then present had been withdrawn. Apparently the fluid reaccumulates at once, and it is impossible to keep the retina applied to the choroid for even a short time. In operating on a patient with a case of detachment, even without a tear, one is impressed by the fact that the retina makes very little effort to adhere and sags off again even when circumstances seem most favorable. This fact has led to the desire to produce an adhesive inflammation, and de Wecker and Masselone's galvanocautery puncture of the sclera in 1882 was one method suggested and practiced by Fano in 1866 and by Galezowski in 1872, but the reaction was often severe.

As I have never performed the Gonin operation, I can mention only a few impressions in discussing it. In the first place, Professor Gonin attacks the enemy in his center, and for this he is much to be admired. He attempts to close the tear and at the same time to produce an adhesive inflammation. His exact measurements are of great importance, for it is no easy matter to orient the tear with the ophthalmoscope. At the same time, it does seem possible that an observer might be able to see through the dilated pupil the exact position of the cautery point. The cautery is evidently the only agent suitable to perform the desired effects, and furthermore has the advantage of being sterile. On the other hand, it is probable that if too great damage is done to the retina, it will shrink and detach further. The amount of heat used seems an important point. I have enjoyed Dr. Schoenberg's careful and scholarly presentation, and hope sincerely that he will meet with success in his cases. Any attempt to add to our knowledge of the treatment for this most intractible condition should be gladly received.

Dr. Alfred Wiener: Dr. Schoenberg has presented an admirable paper on a subject that is of extreme interest to us all. This is a serious subject for consideration and his appeal to us, in order that our experiences may help to a better understanding of what can and cannot be accomplished, should stimulate our members to emulate his example of performing this operation and reporting the results, whether good or bad. I feel rather embarrassed in entering this discussion with only one case to report, but even one case will arouse in one's mind difficulties that are experienced and that one should try to overcome in future cases.

I have nothing to add to Dr. Schoenberg's reference as to which are suitable cases and which are not. His scheme for recording and localization of the tear is to be highly commended, though it may be only approximate. I would especially call attention to his reference to the danger zone, which lies beyond the equator. As most of the tears are anterior to this area, there will be little danger of wounding important structures.

In a case of my own, which was seen at the ophthalmological department of St. Luke's Hospital, the detachment was in the upper and outer portion of the fundus. I was able to demonstrate very distinctly to my assistants the tear in the retina at a point about midway between the equator and the ora serrata, in the region between 2 and 3 o'clock,

about, as Dr. Schoenberg would put it, 10 mm. behind the ora serrata. The perforation was visualized on the sclera at this point and marked with the cautery. After the conjunctival flap was made, the sclera was pierced with the cautery, the cautery was withdrawn and a serous-like fluid escaped. Then the cautery was entered again, the current was turned on for about five seconds and withdrawn and the conjunctival flap was stitched with water-tight suture. The patient was kept in bed eight days, and when examined at that time one could see that I had entered the tear just at the edge and that the detachment had disappeared. From a vision of only movements of the hand there was a vision of 20/30 in that eye and only a slightly contracted field.

There are two steps in this operation concerning which I should like to call your attention. The localization of the tear, to my mind, is the most difficult part of the whole procedure. Up to the present time I believe this can, after all, be made only approximately. One may or may not be right in the localization. Lindner, of Vienna, promises to publish very shortly a method of accurate localization with the large Gullstrand ophthalmoscope to which he has annexed a special perimeter. This will be of infinite assistance. I have a suggestion to make, for which, however, I can offer no actual experience as yet. After the ordinary localization and visualization of the sclera, just prior to the operation, one could pass a sterile needle into the eyeball at the point of an approximate localization and then with the ophthalmoscope examine the fundus for the position of this needle. If it has passed through the perforation, one is ready to enter with the cautery. If not, it must be either in front, to the rear or on either side of the perforation, and an adjustment should be made accordingly. This is a method that I feel is worth the effort. I prefer to use the cautery in puncturing the sclera. Should one perforate a vessel, there is no likelihood of a hemorrhage following. With the knife in the region of the equator, a rather smart hemorrhage might occur that would complicate the operation materially. Just what significance such a hemorrhage may have can only be conjectured. There is always a possibility of a proliferating retinitis following. In closing, I wish to say that I believe that this operation has a great future, but it is well to bear in mind that detachment of the retina is a very serious disease.

DR. JOHN M. WHEELER: I should like to ask Dr. Schoenberg three questions. What has been the effect on the tension in your cases? Do you prefer to have your patients in bed for preoperative study? What is your postoperative treatment?

DR. ISADORE GOLDSTEIN: Four months ago I operated on two patients by the Gonin method. Both operations were failures. At the first dressing, which was five days after operation, the corneae were clear, but the lenses were translucid, which condition later cleared up. The vitreous was full of opacities. The opacities disappeared in a few months. Vision was better only for the first week after operation. To retain the primary position of the cornea, four superficial millimeter incisions were made with a cataract knife at 12, 6, 3 and 9 o'clock. These were then stained with fluorescein. These minute incisions enable one to retain the landmark in reference to the tear in the retina. I used the thermocautery instead of the actual cautery.

DR. ERNEST WALDSTEIN: I should like to ask a question or two. A short while ago, I read a paper delivered by Meller at one of the winter sessions of the Vienna Ophthalmological Society, in which he reports quite a few cases, and asks why his results are so much poorer than the results of his colleague Lindner; he blames his own method. He says that he perforates the sclera in a lightning-like procedure, using a white-hot cautery for a very short time, only from two to three seconds. Lindner, on the contrary, uses a red-hot cautery, leaves it there for from ten to fifteen seconds and sometimes turns the cautery up and down and to the right and left. By that procedure he is more apt from the start to find the tear. The tear itself, according to Meller, seems not of so much importance. He refers to one or two cases in which he did not find the tear, and in which in spite of the absence of such a hole he got good results. Lindner, on the other hand, emphasizes the importance of the tear. He tried to find a method of localizing the tear by injecting fluorescein into the subretinal space, hoping that the fluorescein would show through the tear, but he was disappointed. The fluid merely oozed through the retina, and this method had to be given up. One of the worst experiences that Meller had was the following: He obtained nice results in the first few weeks, and on examining some of the patients a few months later he found a secondary detachment due to the formation of retinal folds radiating from the cauterized area. Lindner did not encounter such an unpleasant experience, which is one of the reasons why Meller thinks that his method of using the white-hot cautery explains his failures. If I am not mistaken, Lindner reports 55 or 57 per cent of permanent success. The question of the hemorrhages also came up. Lindner seems to be of the opinion that a hemorrhage once in a while may not be such a bad factor, since it evidently helps in the formation of granulation tissue, which is supposed to aid in the reattachment of the retina. Meller has had the unfortunate experience of hemorrhages below the retina breaking through into the vitreous. I should like to know whether Dr. Schoenberg has any views about that, and especially whether he thinks that a red-hot cautery is preferable to a white-hot cautery, and how many seconds the cautery ought to be applied.

DR. LEWIS WEBB CRIGLER: Several years ago I had a patient with a large myopic detachment, in which there was a distinct hole in the retina. The detachment completely disappeared following rest in bed and subconjunctival injections of physiologic solution of sodium chloride. A year later the patient was presented before the New York Ophthalmological Society, at which time no trace of the detachment or hole could be seen. The patient's vision and field were completely restored.

I should like Dr. Schoenberg to explain how the retina became reattached in spite of the tear.

Dr. Wootton saw this patient with me at the time of the detachment and confirmed the existence of the hole.

DR. DANIEL B. KIRBY: I wonder whether Dr. Schoenberg agrees with my observations in cases of detachment of the retina. In observing these patients with the aid of the slit-lamp and microscope, in all cases of spontaneous detachment I find great numbers of brown retinal pigment granules free in the vitreous. At first I thought this might be a valuable point in the differential diagnosis between tumor detachment

and serous detachment of the retina, but now I think that it might be pathognomonic of a tear in the retina which allows these free pigment granules to escape through the rent into the vitreous.

Dr. Mark J. Schoenberg: I want to thank you all for the keen interest you have taken in this subject.

In reply to Dr. Knapp's question of whether it is dangerous to cauterize the retina, I say that it is, but it seems that the effect of the heat is limited only to a small area in the retina. There is something peculiar about cauterization; namely, it seems to make no difference how deeply the cautery is introduced. All that is cauterized is the wall of the eyeball. The vitreous does not show any sign of cauterization. I wanted to know how far the fluid surrounding the cautery is heated, and I had the tip of the red-hot electrocautery put in water and introduced my finger gradually, bringing it near and nearer to the tip of the cautery. I could not feel the heat of the cautery, and the part of the cautery immersed in water was as cold as the water. It was important to know whether, and how much of, the heat was imparted to the other tissues (ciliary body, lens, optic nerve), and I feel that at least for a short interval of from two to ten seconds there is no danger of heating the important tissues of the eyeball situated several millimeters distant.

Concerning my experience with hemorrhages, my first case, which was a complete failure, was that of a patient with arteriosclerosis and cardiac disease. The cautery tip was not cherry-red hot. When the eye was examined eight days later, blood was found in the vitreous. It began to absorb several weeks later, but I do not know what became of this blood since the patient left and could not return for further treatment. Generally speaking, one can prevent the entrance of blood from the conjunctiva or episcleral vessels by the application of epinephrine and by sponging the blood carefully away from the area to be punctured before the incision is made. Concerning the occurrence of hemorrhage from the choroid, which question has preoccupied Gonin also, this could be presented by using a cherry-red heat. Gonin thinks that a Paquelin thermocautery is better than an electrocautery in this respect. I prefer the electrocautery, which is more reliable and gives as good results.

Does the lens suffer from ignipuncture? So far I have not seen any opacities of the lens, and Gonin states that he never had a cataract following his procedure, but that he has seen cataracts after Colmattage's procedure.

Dr. Thomson's question is: Why should ignipuncture work in detachment with tears and not in those without tears? I believe that ignipuncture does three things: It seals up the tear, it produces an inflammatory reaction that reattaches the retina, and it does something else that we know nothing about. I think that detachments without tears belong to a different group than those with tears and need a different kind of treatment.

Dr. Crigler has reported on his interesting case of spontaneous reattachment. Perhaps it was a case belonging to the inflammatory type. Some of these detachments heal spontaneously. The retinal detachments in pregnancy do so. A number of instances of spontaneous reattachments of the retina have been recorded in the literature, but the cause of this occurrence is unknown.

I think that Dr. Wiener's suggestion to introduce a needle first to localize the tear is interesting. Perhaps it is not necessary after one becomes familiarized with the technic of localization. I feel that it is not essential to get the cautery right through the center of the hole. In one of Dr. Knapp's cases, he struck the tear on one side. The tear could be seen for several weeks after the operation, but it disappeared later on. Apparently if you come within a certain distance of the tear you produce enough reaction to seal it up, and if you are too far the ignipuncture has to be repeated.

Should one always make an incision before using the cautery? There are cases in which we have to make an incision, and other cases in which the puncture is made with the cautery. To my mind, when the eye is unusually soft, it is better to go in with the cautery without making an incision beforehand. There is more loss of vitreous when one first makes an incision. In a soft eye I have used the cautery without a preliminary incision. In some cases the incision has to be made very far back. In such cases, a preliminary tenotomy should precede the ignipuncture.

Dr. Wheeler has asked some interesting questions. As to the tension, immediately after the operation, the eye, of course, is very soft. Later on the eye regains its normal tension. The first thing we do after an operation is to see how the fundus and media look. A large grayish-white area is seen. This area is partly cauterized retina and partly edema, and that part which is due to edema disappears. In one case I did two cauterizations at the same sitting, and then to my dismay I saw an edema of the macular area itself. That edema disappeared entirely eight days after the operation.

Dr. Wheeler's next question is, when is the best time to operate? There is a difference of opinion between Vogt and Gonin. The latter author advises that one should operate as soon as possible. Vogt says wait until the fluid sinks to the lower part of the fundus, because if there is a tear on top of a retinal bulla it is difficult to localize it and more difficult to reach it with the cautery. Gonin thinks that the earlier the operation is performed the better the results obtained and the less chance the retina has to degenerate. I am of the opinion that Gonin is right and that in cases that are really indicated for ignipuncture, it should be done as early as possible. We know that the large majority of these cases go from bad to worse. In more than 400 cases reported by Uhthoff, only 5 per cent of the patients recovered despite the use of tuberculin, cauterization, rest, bandaging, subconjunctival injections, etc. Everything we know about the treatment for retinal detachments developed thirty years ago, and before that date. The only contribution that has been made to the treatment for detachments since Uhthoff's report has been by Gonin.

In regard to the postoperative treatment, the patients get as little food as possible. Gonin was anxious to have his patients lie on one side for eight days. He gave them opium and very little food. Gradually he became a little more liberal, and it seems that it does not make any difference if the patient gets out of bed from three to four days after the operation just to go to the lavatory. After one week of rest in bed, the patient has to wear a patch over the eye on which operation was performed and is discharged two weeks after the operation. He may do light work after from four to six weeks.

In regard to Dr. Goldstein's two unsuccessful cases, it is difficult to form an opinion without knowing more about them. I am sure that he is going to keep up his work, and that he will try the Gonin procedure again. Perhaps his cases need more than one ignipuncture.

I can confirm everything that Dr. Kirby has observed. Vogt, in his well known atlas, mentions something about the presence of pigment in the vitreous of eyes with retinal detachments. I think that the presence of a tear and pigment aids in the differential diagnosis of a tumor covered by a retinal detachment. When pigment and a tear are found, the detachment is not due to a tumor. Of course, there may be a coincidence of both, but no causal relationship.

Dr. Waldstein's questions are of practical value. Should the cautery be brought up to white or only to red heat? How many seconds should the cautery be applied? At the present time, no one can state definitely what the optimum heat and length of time necessary to obtain the best results are. Experience and experimentation will give the answer in due time. I think that the principle to follow is that one must endeavor to use as little heat as possible and to apply it as short a time as possible. In my experience, from five to ten seconds, never more, and a red heat just sufficient to cauterize, to seal the bleeding blood vessels and to prevent adhesion of the wall of the eyeball to the cautery are sufficient.

Microscopic Observations in Experimental Ignipuncture of the Retina. Dr. M. G. Herzfeld (by invitation).

The nature of this work, undertaken at the request of Dr. Schoenberg, is to show what actually happens pathologically in experimental ignipuncture. The experimental work is as yet not far enough advanced to give anything definite, this being purely in the nature of a preliminary report. The eyes of two rabbits were operated on by Dr. Schoenberg. Two of them were removed immediately after puncture, the punctures being both deep and superficial. With the other rabbit, a similar procedure was followed. It was allowed to live for ten days, at which time the eyes were removed. On removal of the first two eyes, there was found microscopically, at the point of the puncture, a firm attachment of the retina to the choroid, the former having a definite striated puckered appearance. This also held to a lesser degree in cases of superficial puncture. Microscopically, the eyes of two weeks' standing showed the same condition. Microscopically, the only definite observations in all these cases was a massing of the uveal pigment at the point of retinal attachment with a slight infiltration of round cells. There did not seem to be any changes in the retina. The sclera, except for necrosis at the point of puncture, showed nothing abnormal. There was a slight infiltration of leukocytes in the conjunctiva near the point of the burn. To sum up: In the work done thus far, ignipuncture shows changes mainly in the uvea and a peculiar attachment of the retina. Much more work must be done before any definite conclusions can be reached.

Optical Considerations in Localizing Retinal Tears. Dr. Harry A. Goalwin (by invitation).

When we realize that a tear which seems to us to be at a definite point in the retina may actually be 6 mm. away from that point, and that

this refractive displacement is greatest in the part of the eye that is most accessible to operative intervention, we shall understand how important it is to localize the tear with the greatest practicable precision.

I shall describe the exact location of a retinal tear by giving the meridian in which it is located and its shortest distance from the limbus (straight line). The determination of the meridian is simple. I am concerned mainly with localization within the meridional section through the tear.

Let us consider a ray of light that enters the eye at the margin of the pupil. It will be refracted at the various surfaces, and, if after that it strikes the anterior nodal point of the eye, it will proceed to the retina from the posterior nodal point, in a direction parallel to the original ray, until it strikes the retina. Let us reverse this process and trace a ray from the retina outward. For definite reasons I shall assume a pupil of 5 mm. We find that as we proceed forward from the pole along the retina, we reach a critical point at a distance of 11 mm. A ray proceeding from a point beyond that toward the posterior nodal point will be stopped by the iris. The ray that will become visible to an observer will be the one nearest to the former which at the same time just emerges at the pupillary margin.

By using the Gullstrand schematic eye, I have traced graphically the courses of these rays as they proceed from points between 12 and 24 mm. from the pole, being 1 mm. apart. After tabulating the actual and corresponding apparent positions of the points, I constructed a graph showing the relation between the two. To my great surprise the points were found practically on a straight line. The slope of this line is 6/10 and its intercept on the X-axis is 1.6 mm. Its equation, therefore, is:

$$X = 6/10\ Y + 1.6 \text{ mm.}$$

If the ora serrata is assumed to be at a distance of 6.5 mm. from the limbus, if B_{os} is the apparent distance of a tear from the ora serrata and if A_{1c} is the actual distance of the tear from the limbus, measured along the chord, then $Y = 12.5 - B_{os}$ and $X = 19.0 - Alc$; hence

$$Alc = 6/10\ B_{os} + 9.9$$

If B_{os} is expressed in disk diameters, we have, since 1 disk diameter is 1.5 mm.:

$$Alc = 9/10\ B_{os} + 9.9$$

I wish to state most emphatically that while this is the most precise method so far proposed it is not the most precise that my work has made possible. In order to obtain the greatest precision from this work it is necessary to measure carefully the angle which the observer's line of vision makes with the optical axis of the observed eye when viewing a retinal tear. The distance of the tear from the limbus that corresponds to this angle is fixed and can be determined from my tables or graphs.

Let us say that a retinal tear seems to be situated 2 disk diameters from the ora serrata. By substituting in the last formula we get 11.7 mm. as its actual distance from the limbus.

Another important consideration is the length of a tear. This will appear greater than it actually is. At the most peripheral point a millimeter will appear 1.75 mm. long. At the equator a millimeter will

appear 1.65 mm. long. This applies only in the anteroposterior direction. In other words, an object on the retina viewed obliquely will appear elongated in the direction of the meridian. This elongation is about 5 mm. behind the equator in 60 per cent, at the equator in 65 per cent and at the ora serrata in 75 per cent.

THE WEEKERS METHOD OF EXPERIMENTAL PRODUCTION OF RETINAL DETACHMENTS. DR. V. R. SYRACUSE (by invitation).

In 1925, Weekers, of Belgium, while experimenting with rabbits, discovered that cautery puncture of the sclera (upper pole) produced a detachment of the retina. This detachment began at once in the upper fundus and developed the same series of events observed in idiopathic detachment of the retina in man. Histologic examinations of serial sections of eyes cauterized in the same manner, but enucleated at varying intervals after ignipuncture, revealed the following changes: In superficial episcleral cauterization, the episclera is slightly infiltrated and edematous. The scleral tissue itself may not show a well marked lesion. The choroid is enormously congested and thickened. It takes two weeks for this congestion to disappear. A very abundant transudate forms at once under the retina, and in the intraretinal space between the pigment layer and the layer of rods and cones. The intraretinal accumulations of fluid may also coalesce and rupture through the pigment layer into the subretinal space. This fluid then begins its downward descent as the retina reattaches itself above it, until the lowest point in the subretinal space is reached. Fluid persists there for more than a year. Within two weeks the retinal layers gradually become less distinct as they undergo atrophy and reattachment. Accumulations of proliferated pigment now infiltrate all the coats of the eye, which are now closely adherent in a firm cicatricial union.

Book Reviews

THIRD ANNUAL REPORT OF THE GIZA MEMORIAL OPHTHALMIC LABORATORY, CAIRO, 1928. Pp. 112. Egypt: Department of Public Health.

This report deals chiefly with studies of trachoma and gonococcal conjunctivitis.

During the course of experimental work on monkeys, it was observed that follicles are frequently present in the normal conjunctiva of these animals. This condition is not trachoma, and never turns into it. It can be produced artificially by inoculation with a gram-negative bacillus, closely resembling that described by Noguchi, and which was isolated from cases of trachoma in human beings. During seven months, no corneal vascularization or scarring was observed. Acute trachoma, as described in other countries, never occurs in Egypt, acute exacerbations being due to a mixed infection. Prowazek and Lindner's bodies were encountered but rarely, and were considered to be of no etiologic significance. Serologic investigations were disappointing.

The relative values of new and old remedies were investigated. In the case of chaulmoogra oil, which was rubbed into the conjunctiva, it was decided that: 1. It is not a specific therapeutic agent, but has valuable antitrachoma properties. 2. It is possibly inferior to copper sulphate in the earlier stages of the disease, but is preferable to corrosive mercuric chloride in the later stages. 3. Its use is attended by less discomfort than that of the older remedies. 4. The time of treatment is not shortened.

Carbon dioxide snow was found to be inferior to copper sulphate and frequently produced a conjunctivitis as difficult to treat as the original condition.

Investigations of the treatment for fleshy pannus revealed a useful therapeutic procedure. Triphal (Hoechst), which is the sodium salt of auro-thio-benzimid azol carbonic acid, was injected subconjunctivally in doses of 0.01 Gm., repeated every four or five days. An average of seven injections was required to clear the cornea. It was concluded that: 1. The use of a gold compound is valuable in the treatment for fleshy pannus. 2. Its use produces results superior to those obtained by the former procedure (scraping the cornea). 3. Its disadvantages are its cost and the discomfort to the patient.

In studying gonococcal conjunctivitis it was established that gonococci from the conjunctiva resemble the genital strains in all respects. The peritoneal fluid of rabbits and guinea-pigs was found to possess bacteriolytic power, with phagocytosis as an additional protective factor. In guinea-pigs the serum did not develop agglutinins or bactericidal substances, but in rabbits certain bactericidal properties were induced.

The relative efficiency of several remedies was investigated:

1. Hospital routine, consisting of applications of 2 per cent silver nitrate, and cleansing with a 1:5,000 solution of corrosive mercuric chloride.

2. Injections of milk, given intramuscularly every day in the amount of 1 cc. for each year of life.

3. Antidiphtheritic serum, 8 cc., given intramuscularly every day or on alternate days, depending on the effect.

4. S. U. M. 36 (the symmetrical urea of meta-benzoyl-meta-amino-benzoyl-amino-naphthol-3-6 sodium sulphate) given every three days in doses of 0.01 Gm.

In 2, 3 and 4, treatment with silver nitrate and corrosive mercuric chloride was carried out as well.

Results of Investigations

Method of Treatment	Average Total No. of Injections	Average No. of Days Required for Cessation of Discharge and Swelling
Hospital routine	.....	10.00
Injections of milk.....	3.125	3.00
Injections of antidiphtheritic serum...	3.500	6.60
Injections of S. U. M. 36.....	2.230	6.38

It is concluded that milk is a most valuable agent in the treatment for gonococcal conjunctivitis.

Antigonococcal serum gave results similar to antidiphtheritic serum, and was considered to have no specific effect. Its local application was found to be both useless and dangerous.

Mercurochrome-220 soluble, given intravenously or locally, was of no demonstrable value.

G. M. BRUCE.

CORRECTION

Prof. Ernst Fuchs has noted the following errors in the translation of his papers:

In "Classification of Retinitis" (ARCH. OPHTH. **3:** 393 [April] 1930), page 393, third line from the bottom, not "tissue," but "lesion," should appear; page 394, in the table, first column, not "septoiodol," but "septoiod"; page 394, in the table, fourth column, not "total blindness," but "total color blindness"; page 397, fourth line from the top, not "In," but "It is destroyed in"; page 397 fifth line from the top, not "as well as," but "and"; page 397, thirteenth line from the bottom, not "glaucoma may occur," but "it may occur in glaucoma"; page 398, seventh line from the top, not "Adhesions" but "Lesions"; page 398, fifteenth line from the top, not "methyl," but "ethyl"; page 398, thirteenth and fourteenth lines from the bottom, not "crescent-like atrophy," but "in cases of a white crescent," and page 402, first line, not "they," but "the toxins."

In "Consequences of Softening of the Eyeball" (ARCH. OPHTH. **3:** 419 [April] 1930), page 420, ninth line from the bottom, not "shape" but "fold" should appear.

Directory of Ophthalmologic Societies *

FOREIGN

Oxford Ophthalmological Congress

Master: Dr. A. B. Cridland, Salisbury House, Chapel Ash, Wolverhampton, England.
Secretary: Dr. C. G. Russ-Wood, 12 St. John's Hill, Shrewsbury, England.

NATIONAL

American Medical Association, Section on Ophthalmology

Chairman: Dr. George F. Suker, 25 E. Washington St., Chicago.
Secretary: Dr. William C. Finnoff, Imperial Bldg., Denver.
Place: Philadelphia. Time: 1931.

American Academy of Ophthalmology and Oto-Laryngology

President: Dr. William H. Wilder, 122 S. Michigan Ave., Chicago.
President-Elect: Dr. J. F. Barnhill, Miami Beach, Florida.
Executive Secretary: Dr. William P. Wherry, Medical Arts Bldg., Omaha.
Place: Chicago. Time: October 27-31, 1930.

American Ophthalmological Society

President: Dr. Edward C. Ellett, Exchange Bldg., Memphis, Tenn.
Secretary: Dr. Emory Hill, Professional Bldg., Richmond, Va.

SECTIONAL

New England Ophthalmological Society

President: Dr. S. Judd Beach, 704 Congress St., Portland, Maine.
Secretary-Treasurer: Dr. E. B. Dunphy, 520 Commonwealth Ave., Boston.
Place: Massachusetts Eye and Ear Infirmary, 243 Charles St., Boston. Time: 8 p. m., third Tuesday of each month from November to April, inclusive.

Pacific Coast Oto-Ophthalmological Society

President: Dr. Arthur Jones, 105 N. 8th St., Boise, Idaho.
Secretary-Treasurer: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
Place: Victoria, B. C. Time: September 3-5, 1930.

Puget Sound Academy of Ophthalmology and Oto-Laryngology

President: Dr. Walter F. Hoffman, 817 Summit Ave., Seattle.
Secretary-Treasurer: Dr. Francis A. Brugman, Medical-Dental Bldg., Seattle.
Time: 8 p. m., third Tuesday of each month, except July and August.

Southern Medical Association, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Fred Hasty, 119 Seventh Ave., Nashville, Tenn.
Secretary: Dr. Fletcher D. Woodward, Box 162, University, Va.
Place: Louisville, Ky. Time: November, 1930.

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* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date.

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President: Dr. Wilfrid Haughey, 65 W. Michigan Ave., Battle Creek.
Secretary: Dr. R. H. Fraser, Battle Creek Sanitarium, Battle Creek.
Time: Third Thursday of alternate months.

STATE

COLORADO OPHTHALMOLOGICAL SOCIETY

President: A presiding officer is selected for each meeting alternately until all members have served.
Secretary: Dr. Donald H. O'Rourke, 217 Imperial Bldg., Denver.
Place: First floor, Metropolitan Building, Denver. Time: 7:30 p. m., third Saturday of the month, October to April, inclusive.

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR, NOSE AND THROAT

President: Dr. Dorland Smith, 836 Myrtle Ave., Bridgeport.
Secretary-Treasurer: Dr. Walter L. Hogan, 750 Main St., Hartford.
Time: May, November.

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President: W. L. McDougall, 50 Whitehall St., S. W., Atlanta.
Secretary-Treasurer: Dr. William O. Martin, Jr., 384 Peachtree St., Atlanta.

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. H. A. Van Osdol, 320 N. Meridian St., Indianapolis.
Secretary: Dr. Robert J. Masters, 23 E. Ohio St., Indianapolis.
Place: Indianapolis. Time: December 10 and 11, 1930.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. John C. Brown, 350 St. Peter St., St. Paul.
Secretary-Treasurer: Dr. J. H. Morse, 2511 Washburn Ave., S., Minneapolis.

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY

President: Dr. Lee W. Smith, 125 W. Granite St., Butte.
Secretary: Dr. J. G. Parsons, Lewistown.

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. H. B. Beeson, 232 W. De Mers Ave., Grand Forks.
Secretary-Treasurer: Dr. F. L. Wicks, Valley City.

OREGON ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President: Dr. J. W. McCollom, 346½ Washington St., Portland.
Secretary-Treasurer: Dr. Andrew J. Browning, 418 Mayer Bldg., Portland.
Place: Good Samaritan Hospital. Time: Third Tuesday of each month.

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President: Dr. J. E. Raia, 276 Broadway, Providence, R. I.
Secretary: Dr. F. W. Dimmitt, 195 Thayer St., Providence, R. I.
Place: Rhode Island Medical Library. Time: 8:30 p. m., second Thursday in October, December, February and April.

UTAH OPHTHALMOLOGICAL SOCIETY

President: Dr. F. M. McHugh, 17 Exchange Pl., Salt Lake City.
Secretary-Treasurer: Dr. H. Leroy Smith, Ezra Thompson Bldg., Salt Lake City.

VIRGINIA SOCIETY OF OTO-LARYNGOLOGY AND OPHTHALMOLOGY

President: Dr. Fletcher D. Woodward, Box 162, University.
Secretary-Treasurer: Dr. Henry Grant Preston, Harrisonburg.

LOCAL

Academy of Medicine of Northern New Jersey, Section on Eye, Ear, Nose and Throat

Chairman: Dr. Frederick J. Wort, 1080 Broad St., Newark.
Secretary: Dr. Earl LeRoy Wood, 31 Lincoln Park, Newark.
Place: 91 Lincoln Park South. Time: 8:45 p. m., second Monday of each month.

Academy of Medicine of Toronto, Section of Ophthalmology

Chairman: Dr. Louis Joseph Sebert, 86 Bloor St., W., Toronto.
Secretary: Dr. Alexander E. MacDonald, 151 Bloor St., W., Toronto.
Time: First Monday of winter months.

Atlanta Academy of Ophthalmology and Oto-Laryngology

President: Dr. William L. McDougall, Atlantic National Bank Bldg., Atlanta, Ga.
Secretary: Dr. William O. Martin, Jr., 384 Peachtree St., Atlanta, Ga.
Place: Academy of Medicine, 38 Prescott St., N. E. Time: 8 p. m., last Thursday of each month.

Baltimore Medical Society, Section on Ophthalmology

Chairman: Dr. Leo J. Goldbach, 1012 N. Charles St., Baltimore.
Secretary: Dr. Angus Lloyd MacLean, Johns Hopkins Hospital, Baltimore.
Place: Medical and Chirurgical Faculty, 1211 Cathedral St. Time: 8:30 p. m., fourth Thursday of each month from October to May.

Brooklyn Ophthalmological Society

President: Dr. John N. Evans, 23 Schermerhorn St., Brooklyn.
Secretary: Dr. Michael J. Buonaguro, 589 Lorimer St., Brooklyn.
Place: Kings County Medical Society Bldg., 1313 Bedford Ave. Time: Third Thursday of February, April, May, October and December.

Buffalo Ophthalmologic Club

President: Dr. A. F. Luhr, 40 W. North Ave., Buffalo.
Secretary-Treasurer: Dr. Thurber Le-Win, 112 Linwood Ave., Buffalo.

Chicago Ophthalmological Society

President: Dr. Harry S. Gradle, 58 E. Washington St., Chicago.
Secretary: Dr. Richard C. Gamble, 30 N. Michigan Ave., Chicago.
Place: Medical and Dental Arts Club. Time: Third Monday from October to May.

Cleveland Academy of Medicine, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. M. Paul Motto, Rose Bldg., Cleveland.
Secretary: Dr. A. D. Ruedemans, Euclid and E. 93d St., Cleveland.
Place: Winton Hotel. Time: Fourth Friday of each month.

Cleveland Ophthalmological Club

Chairman: Dr. W. E. Burner, Guardian Bldg., Cleveland.
Secretary: Dr. M. P. Motto, Rose Bldg., Cleveland.

College of Physicians, Philadelphia, Section on Ophthalmology

Chairman: Dr. Maxwell Langdon, 1530 Locust St., Philadelphia.
Clerk: Dr. Alexander G. Fewell, 1924 Pine St., Philadelphia.
Time: Third Thursday of every month from October to April, inclusive.

Columbus Ophthalmological and Otolaryngological Society

Chairman: Dr. John E. Brown, 370 E. Town St., Columbus, Ohio.
Secretary-Treasurer: Dr. Albert D. Frost, 681 E. Broad St., Columbus, Ohio.
Time: First Monday of each month.

Dallas Academy of Ophthalmology and Oto-Laryngology

President: Dr. H. B. Decherd, 1717 Pacific Ave., Dallas, Texas.
Executive Secretary: Dr. W. Mood Knowles, 1717 Pacific Ave., Dallas, Texas.
Place: Dallas Athletic Club. Time: 6 p. m., first Tuesday of each month from October to June. The November, January and March meetings are devoted to clinical work.

Detroit Ophthalmological Club

Chairman: Members rotate alphabetically.
Secretary: Dr. Parker Heath, David Whitney Bldg., Detroit.
Time: 6:30 p. m., first Wednesday of each month.

Eastern New York Eye, Ear, Nose and Throat Association

President: Dr. G. G. Marshall, 122 West St., Rutland, Vt.
Secretary-Treasurer: Dr. Arthur F. Holding, 142 Washington Ave., Albany.
Time: Third Wednesday of October, November, March, April, May and June.

Fort Worth Eye, Ear, Nose and Throat Society

President: Dr. W. R. Thompson, 510 Main St., Fort Worth, Texas.
Secretary-Treasurer: Dr. R. H. Needham, Fort Worth National Bank Bldg., Fort Worth, Texas.
Place: University Club. Time: 6:30 p. m., first Friday of each month except July and August.

Houston Academy of Medicine, Eye, Ear, Nose and Throat Section

President: Dr. Claude C. Cody, 1306 Walker Ave., Houston, Texas.
Secretary: Dr. J. M. Robison, Eye, Ear, Nose and Throat Hospital, Houston, Texas.
Place: Medical Arts Bldg., Harris County Medical Society Rooms. Time: 8 p. m., first Thursday of each month from September to June.

Indianapolis Ophthalmological and Oto-Laryngological Society

President: Dr. E. L. Lingeman, 241 N. Pennsylvania St., Indianapolis.
Secretary: Dr. Kenneth L. Craft, Hume-Mansur Bldg., Indianapolis.
Place: University Club. Time: 6:30 p. m., second Thursday of each month from October to May.

Kansas City Society of Ophthalmology and Otolaryngology

President: Dr. A. E. Eubank, Argyle Bldg., Kansas City, Mo.
Secretary: Dr. O. S. Gilliland, Professional Bldg., Kansas City, Mo.
Time: Third Thursday of each month from September to May. The November, January and March meetings are devoted to clinical work.

Long Beach Eye, Ear, Nose and Throat Society

President: Dr. Dean E. Godwin, Security Bldg., Long Beach, Calif.
Secretary-Treasurer: Dr. Ferris Arnold, Security Bldg., Long Beach, Calif.
Place: Pacific Coast Club. Time: Last Wednesday of each month from September to June.

Los Angeles County Medical Society, Section on Ophthalmology and Otolaryngology

President: Dr. A. Ray Irvine, 727 W. 7th St., Los Angeles.
Secretary-Treasurer: Dr. J. Frank Friesen, 727 W. 7th St., Los Angeles.
Place: California Lutheran Hospital, Assembly Room. Time: 8 p. m., first Monday of each month.

Medical Society of the District of Columbia, Section of Ophthalmology and Oto-Laryngology

Chairman: Dr. James A. Flynn, 1511 Rhode Island Ave., Washington.
Secretary: Dr. E. R. Gookin, Medical Science Bldg., Washington.
Place: 1718 M St. N. W. Time: 8 p. m., third Friday of each month.

Memphis Society of Ophthalmology and Oto-Laryngology

Chairman: Each member, in alphabetical order.
Secretary: Dr. R. O. Rychener, Exchange Bldg., Memphis, Tenn.
Place: Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital. Time: 8 p. m., second Tuesday of each month.

Milwaukee Oto-Ophthalmic Society

President: Dr. Edward R. Ryan, 425 E. Water St., Milwaukee.
Secretary-Treasurer: Dr. O. P. Schoofs, 120 E. Wisconsin Ave., Milwaukee.
Place: University Club. Time: 6:30 p. m., third Tuesday of each month.

Nashville Academy of Ophthalmology and Otolaryngology

Chairman: Dr. R. J. Warner, 706 Church St., Nashville, Tenn.
Secretary-Treasurer: Dr. W. W. Wilkerson, Jr., Bennie-Dillon Bldg., Nashville, Tenn.
Place: St. Thomas Hospital. Time: 8 p. m., third Monday of each month.

New Orleans Ophthalmological and Otological Society

President: Dr. W. A. Wagner, Pere Marquette Bldg., New Orleans.
Secretary-Treasurer: Dr. M. F. Meyer, Canal Bank Bldg., New Orleans.
Place: Eye, Ear, Nose and Throat Hospital. Time: Third Thursday of each month from October to June.

New York Academy of Medicine, Section of Ophthalmology

Chairman: Dr. E. F. Krug, 12 W. 44th St., New York.
Secretary: Dr. William F. C. Steinbugler, 815 Park Ave., New York.
Time: 8:30 p. m., third Monday of every month from October to May, inclusive.

Omaha and Council Bluffs Ophthalmological and Otolaryngological Society

President: Dr. Charles M. Swab, Medical Arts Bldg., Omaha.
Secretary-Treasurer: Dr. J. C. Davis, 1615 Howard St., Omaha.
Place: Medical Tea Room. Time: 5:15 and 7:00 p. m., third Wednesday of each month from October to May.

Pittsburgh Ophthalmological Society

President: Dr. Edward B. Heckel, Jenkins Arcade Bldg., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: Pittsburgh Academy of Medicine Bldg. Time: Fourth Monday of each month, except June, July, August and September.

Pittsburgh Slit-Lamp Society

President: Dr. W. W. Blair, 121 University Pl., Pittsburgh.
Secretary: Dr. George H. Shuman, Park Bldg., Pittsburgh.
Place: 121 University Pl. Time: Second Monday evening of every month, except June, July, August and September.

Rochester Eye, Ear, Nose and Throat Society

Chairman: Dr. A. Vincent Walker, 833 South Ave., Rochester, N. Y.
Secretary-Treasurer: Dr. John F. Gipner, 53 Fitzhugh St., Rochester, N. Y.
Place: Rochester Medical Assn., 113 Prince St. Time: 8 p. m., third Monday of each month from October to May.

St. Louis Ophthalmic Society

President: Dr. Charles W. Tooker, 308 N. 6th St., St. Louis.
Secretary: Dr. Carl T. Eber, 1006 Carleton Bldg., St. Louis.
Place: St. Louis or Washington University Cafeteria.
Time: 6:30 p. m., fourth Friday of each month from October to April, inclusive.

San Antonio Ophthalmolo-Oto-Laryngological Society

President: Dr. F. W. Sorrell, Gibbs Bldg., San Antonio, Texas.
Secretary-Treasurer: Dr. A. F. Clark, 728 Main Ave., San Antonio, Texas.
Place: Bexar County Medical Library. Time: 8 p. m., first Tuesday of each month from October to May.

Spokane Academy of Ophthalmology and Otolaryngology

President: Dr. A. N. Codd, 421 W. Riverside Ave., Spokane, Wash.
Secretary: Dr. Marc Anthony, Old National Bank Bldg., Spokane, Wash.

Syracuse Eye, Ear, Nose and Throat Society

President: Dr. Searle B. Marlow, State Tower Bldg., Syracuse, N. Y.
Secretary-Treasurer: Dr. A. Harry Rubenstein, Medical Arts Bldg., Syracuse, N. Y.
Place: University Club. Time: Second Friday of each month except June, July and August.